Integrating Automated Normative Analysis Into Brigade Battle Staffs

A Monograph
by

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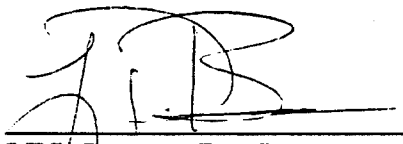

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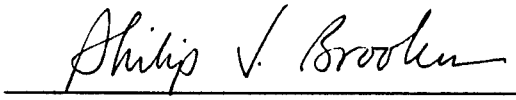

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ABSTRACT

INTEGRATING AUTOMATED NORMATIVE ANALYSIS INTO BRIGADE BATTLE STAFFS by Major Mark L. Curry, USA, 79 pages.

This monograph explores automated command and control for the brigade battle staff. It examines the Army personnel policies and data transmission capabilities, and concludes that the staff is in danger of data and task overload. The paper describes the staff organization and equipment based on 3 current modernization programs: IVIS-Plus, ATCCS Block III, and C2V. It then analyzes the impact of these programs on the staff's ability to execute its doctrinal requirements. This analysis subjectively rates each doctrinal brigade staff task and subtask on its susceptibility to improvement by automation. Based on this analysis, the monograph suggests introducing Automated Normative Analysis (ANA), and evaluates its potential impact. The paper closes with a discussion of some common objections to ANA-enhanced decision making aids.

The future of Army command and control lies in harnessing computers to do more of the rote computational tasks that currently occupy much of the staff's energy and time. The next critical component in the evolution of automated systems is to expedite wargaming, create simple plans, and track key assets and decision points by exploring the utility of ANA.

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I: Introduction

This monograph examines how automated normative analysis might facilitate future brigade battle staffs control the force and better serve the commander by accelerating the decision making process. The brigade battle staff is expected to be redesigned and equipped in the next five years. The monograph assesses the probable composition, resources, and responsibilities of the near-future heavy brigade battle staff. From this vision of the future staff, an assessment is made to determine whether it can fulfill the needs of the brigade and the commander. Next, the monograph examines how further exploitation of automated normative analysis (ANA) might reduce the shortfall between the future battle staff's missions and its capabilities. Finally, it addresses several common concerns regarding the introduction of automated normative analysis into the decisionmaking process.

The traditional brigade battle staff is a multi-disciplinary team that performs four essential wartime functions: provide information, make estimates and recommendations, prepare plans and orders, and monitor execution.[1] The tools the staff brings to these tasks are their individual levels of experience, education, and quality of thought. The Army provides: doctrine, training, tactics, techniques and procedures (TTP), command and control (C2) decision aids, C2 apparatuses (radios, vehicles, telephones, maps, reproduction equipment, etc.), cohesive team building, and reference data. But current personnel policies and near-future, quantum increases in the speed and volume of information thrust

upon the staff are on a collision course. The impact may shortly overwhelm the battle staff's ability to fulfill its mission.

Army personnel policies require that as many qualified majors and Non-Commissioned Officers (NCOs) as possible have the opportunity to serve on battalion or brigade staffs. This broadens the pool of experienced personnel, and prepares them for increased responsibilities.[2] However, this policy restricts combat arms officers to a short twelve month tour as brigade primary staff officers.[3] Most incoming personnel arrive without proficiency in the skills they need for operating and supporting the C2 systems.[4] While most of these primary staff officers will be Command and General Staff College graduates, by the time they report to the brigade staff, many will have been away from Table of Organization and Equipment (TOE) troop assignments for five or more years.[5] Obviously, the time required to learn the staff TTPs and SOPs and gain confidence in manipulating the myriad moving parts of the modern heavy brigade will occupy a substantial part of that year. Many events are conducted only annually, exposing them to only one, or zero, iterations of those operations.[6] Many of the captains who make up the bulk of the brigade staff will have no formal training in staff procedures prior to their assignment to the brigade staff. On station time for captains in TOE assignments is targeted at two years, of which twelve to eighteen months are intended to be spent in company command. This means that virtually no company command qualified captains are available to serve on brigade staffs.[7] It has always been difficult to maintain

a competent, cohesive staff capable of deploying and fighting on short notice, even in the relatively slow paced information and personnel turnover environments we have experienced to date. It will become even more so as tempo of operations, volume of information, and personnel turbulence accelerate.

The volume and tempo of information the brigade staff must cope with are about to increase exponentially due to a major Army initiative to digitize and automate information transfer. The 1992 Force Projection Army Command and Control Action Plan envisions maneuver brigades operating on long haul strategic communications to facilitate their control of operations of intercontinental scope in contingency deployment operations.[8] Ground Based Common Sensor, Ground Control Monitors, and Common Ground Stations are intended for brigades, allowing them to receive intelligence from national, theater, and corps level assets.[9] Internally, the brigade's combat, support, and service support equipment will be equipped with automated reporting systems that will radically increase the amount of information the battle staff must sift and assimilate.[10] These assets will flood the staff with information and intelligence that must be collated and synthesized into a coherent picture.

In the 1980s, the Army introduced the Maneuver Control System (MCS) to expedite and automate information transfer and to perform rudimentary aggregate analysis of data.[11] This initiative facilitated data collection and collation, and expedited turning thousands of bits of certain kinds of easily quantifiable information into intelligible status reports with minimum human interference. These

status reports are the foundation upon which the commander and staff measure unit performance, assess battlefield conditions, and plan.

The Army's digitalization program envisions automating virtually every soldier and combat and support system in the force.[12] Every ground combat trooper, combat vehicle, intelligence sensor, logistics vehicle, and C2 node will automatically communicate with one another sharing friendly and enemy information. The goal is for all soldiers within an organization to share a "Common Picture" of the battlefield, within the scope of their echelon and situation.[13] The system offers the promise of accelerating agility, flexibility, and synchronization beyond the imagination of current battle staffs. Automated data transfer is the heart of the Army Tactical Command and Control System (ATCCS). This flood of additional information is so vast that one of the greatest challenges is simply to find electronic information conduits large enough to handle it. The challenge is handling the increased flow of information within a turbulent personnel environment.

The culmination of these two forces, short term staff experience, and the staffs sudden immersion in a command post awash in an unprecedented volume of information will challenge our ability to execute the traditional decisionmaking process. The Army recognizes this challenge, and the opportunities automation offers to assist the staff in dealing with it. These solutions are embedded in the mid-to-long-term conceptual development of ATCCS.[14] But the ability to manipulate this glut of data represents only the next step in the Army's long term goal for automated decision aids, known as

ATCCS Block III. We are currently in the conceptual phase of designing ANA to assist the brigade battle staff in decision making, instead of just battle tracking and projecting a common picture of the battle space.[15] This will be the focus of ATCCS Block IV. Consequently, now is the time to examine what the Army wants of the ANA component and hence the focus of this paper.

The monograph examines how ANA can be concretely applied to the workload of the brigade battle staff. The focus of the effort is on tactical problem solving, not on hardware or specific software solutions. None of the utilities proposed are outside the realm of current off-the-shelf technology that has already been tested for similar applications. They simply represent a change of emphasis from data transfer to analytical processing and integration of normative analysis in the program development. The following are key assumptions:

1. Automation must support the commander, not become a substitute for commanders. The Force Projection Army Command and Control Action Plan (FORCPAC2) reasserts that the essence of battle command remains the same, indelible, and unitary. [16]

2. Control, being more scientific than command, must keep pace with technological change. Commanders control the force "...by employing the staff and the computer, communications, control, and intelligence systems...."[17]

3. Man remains the key link in the chain; the machines are there to facilitate man's work, not to replace him. Our goal is to free the staff to focus on exercising initiative, judgement, and on

the creative elements of control and decision making. Machines refine and process raw data and perform the calculations and comparisons currently performed by the staff manually.[18]

4. This refining process will be slaved to the specific needs of the commander and staff, and reflect their units' SOPs, not a generic Army 'school solution'.

5. The basic staff responsibilities will remain unchanged from FM 71-3 Armored and Mechanized Infantry Brigade, FM 71-3 Mission Training Plan (MTP) for the Heavy Brigade Command Group and Staff, and FM 101-5 Command and Control for Commanders and Staff (Coordinating Draft).

6. The brigade battle staff composition and resources will coincide with the brigade staff proposal outlined in Section II.[19]

7. The ATCCS Block III programs discussed in Section II will work as advertised, and that enemy countermeasures or friendly electronic fratricide will not pose a significant hindrance.[20]

II: The Brigade Command Posts - Near Future

The functions of the brigade staff are expected to endure for the foreseeable future. The critical missions of battle tracking and assisting the commander in the decision making process will remain the cornerstones of the battle staffs' domain.[21] However, the configuration, tools, and workload of the staff will change substantially under three new initiatives expected in the next five years. These are: the Command and Control Vehicle (C2V) mobile

command post, the ATCCS Block III Upgrade, and the Intervehicular Information System (IVIS). Because all are still in testing or development, their final capabilities will vary to a certain extent from the projections we will make here, though it is still possible and prudent to analyze their impacts. Regardless of the accuracy of the Army's predictions, it is clear that these three programs will operate synergistically to change the fundamental working conditions and requirements of the brigade battle staff.[22]

The physical environment of the staff will be transformed in the decade between 1997 and 2005 by the C2V mobile command post program. The brigade command posts (CPs) will be housed in armored modules mounted on five XM-4 modified Multiple Launch Rocket System chassis.[23] The primary goal is to provide a platform that: allows the CPs to keep pace with the brigade's maneuver elements, ballistically protects the staff, eliminates the unique target signature of the M-577, and accommodates decisionmaking aids necessary for the staff to operate on the move.[24] Each module is designed to accept six personnel, with up to four operating individual computer workstations. The exact configuration of each vehicle, and their placement in the three CPs, TAC, Main, or Rear, will be at the commander's discretion, but the program intent is to cross-load staffs to facilitate coordination and prevent the complete loss of a battlefield operating system if a vehicle is lost.[25] (See Annex A)

Attached or supporting units will integrate their vehicles, C2V or otherwise, as necessary. It is expected that the Intelligence and Electronic Warfare Support Element (IEWSE), the Fire Support Element

(FSE), and the Assistant Brigade Engineer (ABE) will each bring a C2V to the TOC.[26] Each vehicle will have a powered, self-erecting, extended mast antenna, and communicate via radio, Mobile Subscriber Equipment (MSE), the Army data distribution system, satellite communications (SATCOM), and commercial network broadcasts like CNN.[27] Communication between vehicles on the move will be by low-powered wireless Local Area Network (LAN), with a spooled wire LAN available for stationary operations. Communications with more distant units and staffs, CONUS installations, forward displaced commanders and support bases will be by MSE, radio, or tactical satellite. Internally, staff personnel will communicate by headset communications and computer interface with units and other staff personnel, either person to person or in conference calls.[28] The individual staffer will work from an integrated seat that will facilitate operations on the move, and permit him to sleep in that chair to accommodate continuous operations.[29]

The impacts of the C2V are considerable. Even without the prodigious growth of information expected to be generated by automation, the C2V itself challenges how the brigade battle staff must be trained and organized. While the program:

> "is not intended to change maneuver unit personnel authorizations,... there will be less space in the mobile C2V Command Posts. The automated... systems must provide sufficient time savings to allow staff sections to perform the required functions with less personnel."[30]

> "Staff personnel must also become multi-functional to operate outside their narrow branch-

> specific expertise. This trend towards generalism will be necessary due to the lack of redundant personnel supporting primary staff officers and NCOs in the C2V CPs."[31]

The impact is that the decreasingly experienced staff must become increasingly proficient with a broader range of skills, even as they deal with more information in shorter time.

While the C2V is being designed to accommodate any configuration of computers or other decision aids, the system is being built around ATCCS.[32] The primary feeder of ATCCS at the Brigade level will be the Intervehicular Information System, IVIS. Though this system is currently focused on the internal operations of individual tank crews, and limited intravehicular data transmission, its future application is envisioned to be the primary means of "exchanging command and control data and information among combat, combat support, and combat service support elements of a combined arms organization."[33] To differentiate between the two versions, we will refer to the expanded, intra-vehicular program as IVIS-Plus.

The system essentially transmits soldiers' and systems' locations, their fuel and ammunition status reports, and the enemy situation in their area into the parent C2 system, the Maneuver Control System, (MCS).[34] MCS then collates the data and automatically retransmits it to each appropriate echelon of command, so that all systems share a common picture of the battle space.[35] While the soldier at every IVIS-Plus equipped system can manually update his reports, the system reports automatically from on-board sensors and position-navigation (POSNAV) systems without soldier interface.[36] Other preformatted reports, such as casualty, maintenance, and supply

reports must be filled out by the leader, then transmitted digitally over IVIS. The system will also send and receive computer graphics and overlay them onto on board digitized computer maps, permitting rapid distribution of overlays and orders. All this reduces the staffs' and crews' reliance on voice transmission status reports, allowing them to focus on leading, fighting, planning, and supporting.[37] Reports are automatically aggregated at each level, then transmitted to the next higher headquarters.[38]

The system can shorten operation plan refinement times by allowing leaders reconnaissance parties to recommend adjustments while they are still forward by digital transmission to the commander or planner. Fire Support Teams (FISTS), Combat Observation and Lasing Teams (COLTs), and Ground Surveillance Radars (GSRs) will also feed and be fed by the system, as well as brigade and higher echelon assets. Because the system aggregates data at each echelon, and will project computer graphic images of this aggregated data, the brigade command group will be constantly fed with updated situation and information reports from adjacent, higher, and subordinate headquarters. The MCS-compatible computer image decision graphics associated with the IVIS-Plus will dramatically reduce the hands on, manual, voice transmission methods that the brigade staff currently uses to track the battle. However, the constant flow of information and competing ideas from adjacent, higher, and lower commanders and staffs having unprecedented access to the brigade staff, will make it difficult to adjust to rapidly changing circumstances.

The final element in the C2 modernization program is the MCS

upgrade. MCS is one of five ATCCS Functional Subsystems (FSS) at the brigade level, the others being: Advanced Field Artillery Tactical Data System (AFATDS), Forward Area Air Defense Command, Control, Communications,and Intelligence (FAADC3I), All Source Analysis System (ASAS)[39], and the Combat Service Support Control System (CSSCS).[40] All five systems are capable of operating independently, but MCS is the final integrator for all subsystems, and is the only system that the commander and all staffs will have direct access to at all times on the battlefield.[41] MCS is intended to ultimately provide Force Level Control, whereas the other four orient on Force Level Information.

> "MCS is the ATCCS Functional Sub-System that directly supports the combined force commander and staff by providing automated support for planning, coordinating, controlling and using maneuver functional area assets and tasks, coordinates, and synchronizes the supporting arms in the conduct of operational planning, field operations, and training."[42]

The next MCS upgrade, expected in 1996, belongs to the ATCCS Block III program, and focuses primarily on: improved information distribution, graphic presentation of a common battlefield picture for both enemy and friendly units, unit status presentation, and operations or warning order (OPORD/WARNORD) transmission.[43] This development should ease the burden of the radically increased data flow created by IVIS-Plus type systems, and exacerbated by the spartan level of staffing dictated by the C2V program. Whether or not the revised MCS can fully compensate for these new challenges remains to be seen, but at least this critical need has been addressed.

The Army recognizes that even the upgrade to ATCCS Block III MCS may leave the battle staff further behind in the decision cycle

competition. Our challenge today is to develop a system of systems that eliminate as much 'housekeeping' duty from the battle staff as possible. This will free them to concentrate on the conceptual, intuitive, and judgmental aspects of controlling the brigade.

The long range future of MCS lies in this interactive realm of the decision making process - tasking the automation to compare complex options, or even to create simple, less critical plans. These functions are beginning to be explored under the third-subsequent-from-now version of MCS under ATCCS Block IV Course of Action Wargaming and Movement Control Applications.[44]

Despite the existence of no less than twenty Course Of Action (COA) Analyzer prototypes using four different computer operating systems, progress on the Course of Action Wargaming and Movement Control modules has been stymied by an inability to define their mission requirements.[45] Because these programs are in the conceptual phase, now is the time to explore how they might be most usefully employed and developed. This will be the focus of Section IV.

In summary, the brigade battle staff of the near future will operate from a highly mobile platform that permits continuous operations by an austere staff that must be generalist in nature, though still retaining subject matter expertise responsibilities. This staff will be fed bottom-up information from an expanded, semi-automated data transfer system that aggregates subordinate and supporting unit's statuses, and transmits them graphically to ATCCS Block III MCS or other ATCCS Functional Subsystems. The battle staff, manning these systems in C2Vs, will communicate by voice and digital

transfer between each other and the commanders to portray a common picture of the battle space and transmit orders and overlays with standard format reports and graphic displays. This information sharing will incorporate all combat soldiers and weapon platforms, support, and service support systems.

Having examined the composition and physical environment of the near future battle staff, the monograph assesses the impact these changes will have on how well the staff performs its doctrinal tasks.

III: The Impact of ATCCS Block III MCS on Brigade Battle Staff Doctrinal Requirements

ARTEP 71-3-Mission Training Plan (MTP) for the Heavy Brigade Command Group and Staff identifies fifteen staff elements, divided among the three command posts that house the brigade battle staff. These staff elements are responsible for 71 different tasks, consisting of 226 subtasks.[46] The purpose of Section III is to examine the degree to which the near term modernization programs described in Section II will effect the brigade staffs' performance of these tasks. The primary basis for this analysis is the Functional Analysis of the brigade staff postulated by the 1993 C2V Program's Operational Concept. Staff elements not analyzed by the C2V program have been analyzed by the author. The narrative description of modernization's impact is below. Details of the analysis are presented in Annex B.[47]

There is an inherent difficulty and danger in projecting the

precise impact of near term modernization and automation due to the prototype nature of the C2V, IVIS-Plus, and all of the ATCCS Block III Functional Sub-System programs, including MCS. Consequently, this analysis is based on the best data available as of November 1993, acknowledging that it will inevitably change between now and final fielding.

The brigade battle staff has been broken down into four subsets to facilitate describing the impact of the near-term modernization, and to avoid repetition. The first element is the Special Staff and the Executive Officer (XO); S5 Civil-Military Officer (CMO); Communications Element (CE); Military Police (MP); Brigade Surgeon; Brigade Chaplain; and Headquarters and Headquarters Company Commandant. While none of these sections are assigned automated decision aids in the C2V or Block III MCS programs, all have access to MCS and other Functional Sub-Systems through their associated Coordinating Staff counterparts.[48]

The Special Staff is responsible for 14 tasks and 54 subtasks, and is the group least effected by Block III MCS. Much of their work requires personal contact to be effective, hence is not easily accommodated by automation.[49] However, 35 of their functions will benefit from the common picture and terrain analysis capability of the new system. Primarily, each staff element can use Block III Functional Sub-Systems to identify and disseminate: locations from which they can best support the force, alternate routes, Host Nation Support (HNS) facilities and resources, likely choke points, communication line of sight (LOS) profiles, air-evacuation sites, and

CP locations. All of this work requires manual input. Analysis and tracking is done by database queries, but this will nonetheless expedite initial analysis of possible solutions to mission requirements. Additionally, their manual input to the automated common picture will expedite coordination with supported units, who will no longer have to wait for the completed operations order and annexes for crucial information. The Commanders' Critical Information Requirements (CCIR) will be accommodated by the graphic display of information, facilitating rapid comprehension of the myriad details of the brigade's rear operations.

ATCCS Block III does not solve all the Special Staff's challenges, however. It will do little to alert them to subsequent changes in conditions that may invalidate their analysis, such as changed boundaries, destroyed facilities, depleted resources external to the military supply system, enemy activity or terrain management conflicts. Because the Special Staff lacks dedicated access to the database, they must rely on their Coordinating Staff counterparts to alert them to these changes. Consequently, ATCCS Block III provides the Special Staff with at best a snap shot of the battlefield situation, which will deteriorate over time until they can regain access to an MCS terminal.

The Personnel and Administrative (S1) and the Logistics (S4) sections (Administrative-Logistics) are responsible for 17 different tasks, with 50 subtasks.[50] ATCCS Block III MCS, Combat Service Support Control System (CSSCS), and the Terrain Evaluation Module (TEM) will improve the Administrative-Logistics staffs' efficiency

and effectiveness in 33 of the subtasks (see Annex B). They will derive the most utility from their new ability to track and audit the status of units, individuals, supplies, and facilities.

The S1's critical tasks of strength accounting, personnel actions, and casualty reporting and tracking will be expedited and made more accurate. The S1 will be able to check automated unit status reports against database files, aid station and hospital reports, personnel action reports received by higher and lower headquarters, and personnel replacement reports. Personnel forecasting will be improved by the increased accuracy and timeliness of data regarding losses, MOS-mismatches, and replacements.

The S4 will have near real time visibility of supply stockage and equipment operational ready rates. He will be able to track transportation assets' locations and status, supply point statuses up to corps level, road conditions, and critical deployment status from CONUS to the brigade through CSSCS and TEM. Rudimentary movement planning based on TEM will allow the S4 to calculate units' movement times based on route lengths, conditions, and unit size.

Unlike the Special Staff, much of this information will be received digitally, so there will be a minimum of manually entered data, freeing staff to concentrate on problem solving and forecasting. The entire Administrative-Logistics staff can improve their response to the Commanders' Critical Intelligence Requirements (CCIR) due to the timeliness of their data and the common picture they build and share. Essentially, the Admin Log staff's tasks are improved by a faster, more accurate, less manpower intensive system,

that frees them to focus on sensitive judgmental and qualitative problems.

The Intelligence (S2) and Operations (S3) sections (Operations-Intelligence) are charged with performing 27 critical tasks, with 84 subtasks. Fifty-one subtasks will be significantly enhanced by ATCCS Block III, IVIS-Plus, and Terrain Evaluation Module (TEM).[51] The greatest single advantage derives from their capability to portray and operate from a common picture of the enemy, either as manually templated or automatically compiled from many sources within and outside the brigade.

A common picture permits faster and more accurate manual integration of friendly collectors, reconnaissance and surveillance plans, threat assessment and capabilities, and interaction between intelligence sections at different echelons as well as internally within the brigade battle staff. Assuming the terrain in the area of operations has been digitized, TEM can automatically construct Modified Combined Obstacle Overlays (MCOO), dramatically reducing the lead time S2's require to support the planning process.[52] This also facilitates rapid, but still manual, development of the doctrinal, situational, event, and decision support templates.[53] The preformatted intelligence summaries (INTSUM) and Intelligence Annexes expedite the compilation of the OPORD/OPLAN, and automated and graphic reliant transfer of information ensures that all echelons and CPs are quickly working off the same database.

Additionally, Block III MCS interface with the IEWSE will facilitate tracking non-brigade MI assets within the brigade area

(terrain management), and the IEWSE's Common Ground Station and Ground Station Module components will allow the brigade access to authorized division, corps, theater, and national assets.[54] This will be particularly important because of its link to the All Source Analysis System (ASAS), at division.[55] This will provide the brigade commander the opportunity to see the battlefield 'beyond the range of his guns' for the first time. In summary, the S2 section is primarily assisted by terrain evaluation and common picture capabilities freeing it to devote more time to analysis.

The S3 functions will be the most dramatically effected by ATCCS Block III MCS. The common picture is the key to synchronizing maneuver, fires, and obstacles.[56] Its ability to portray accurate, real time unit locations and status will reduce much of the guesswork and time lag currently present in the synchronization process.[57] Disciplined use of MCS, IVIS-Plus, and TEM will allow the current operations cell to track unit locations and capabilities, track obstacle and battle position preparation, facilitate passages of lines, terrain management, manage the rear threat, target updated enemy ADA sites for SEAD, and trigger CONPLANS. All of these actions are currently manpower and management intensive due to their complexity and dispersed natures. Even when units can report accurately and on time, the process of taking spot reports, transcribing them, manually posting them to the map, and disseminating them to all concerned parties consumes much of the operations staff's time. Even more time consuming is the requirement to call for tardy reports from beleaguered commanders and staffs. The

common picture will ease this burden, if properly resourced and manipulated.[58]

TEM will assist in developing courses of action. Its line of sight analysis and weapon's range fans allow battle staffs to evaluate potential OPs, BPs, and obstacle locations. CP locations and signal node sites can be similarly tested to ensure constant communication. This process will admittedly remain manual and time consuming, but still faster and more accurate than the paper map analysis presently in use.[59]

Another important element for both the S2 and S3 staffs is the ability to mark units or locations that correspond to or trigger the CCIR. While the alert of action at that location will remain manual, i.e. the operator must know what to look for and must periodically make a conscious decision to do so, these actions can be tracked throughout the battle. They can even be marked to correspond to different phases of the operation.[60]

ATCCS Block III's database potential will be the great time saver for the S3, who must habitually manage a copy of nearly every staff section's overlays. By calling up the required combination of overlays, and deleting those not immediately needed, the commander and S3 can package and manipulate the data to project the exact picture they need to make a decision, then pass their annotated picture to all other MCS served CPs that need it. This will eliminate wrestling with innumerable hard to read and copy overlays, and time, clarity and accuracy will all be greatly improved. This does not mean that plastic and paper overlays and maps will not be created. The

threat of electronic damage to the CPs requires that paper backups be made, and all leaders not equipped with MCS terminals will have to operate from traditional graphics. But maps and overlays can be copied straight off of the database by copiers interfaced with MCS.

In summary, the Operations-Intelligence team will benefit from both the common picture and the rudimentary analytical capacity built into the MCS. The ability to portray the most accurate and timely friendly, enemy, and terrain picture, overlaid with subordinate, internal, and higher echelon graphics will facilitate planning, monitoring and synchronizing the battlefield. The analytical capabilities will remain relatively crude, with manual and discrete event analysis required, inhibiting examination of realistically complex battlefield interactions. Nonetheless, speed and accuracy of the estimate and course of action development and wargaming will all improve.

The Supporting Combat Arms are the Fire Support Element (FSE), Army Aviation Liaison Team, Assistant Brigade Engineer Element (ABE), and the Air Defense Battery Commander. The brigade Air Force Liaison Officer (ALO) missions are subsumed into the other arms' tasks, and are not specified under a discrete section by Army doctrine.

In common with all other groups, the supporting combat arms benefit from and contribute to the common picture. Eighteen of their 39 subtasks are improved by ATCCS Block III. This will facilitate fire planning, obstacle placement, and deconfliction of terrain for both brigade and higher echelon elements. It will also ease deconfliction of airspace use through various phases of the battle by

providing real time data from across the force. The FSE, ADA LNO, and all other users, can plot range fans against known or suspected targets, and orchestrate which asset to employ to increase utility of fire support. Instant alert of Target Acquisition Battery locations and the status of their radar sweep will facilitate the FSO's track of the counterfire program. Both the ABE and FSE can semi-automatically track ammunition expenditure versus known requirements to monitor the execution of the plan. The ABE can track the progress of the barrier and survivability plans from the automated feedback from IVIS-Plus to ATCCS Block III MCS.[61]

The AVN LNO can plan and adjust air routes around planned fire support positions to permit all weapons to be used to their best potential within the constraints of the situation.[62] He can then rapidly transmit this information back to the affected aviation unit to keep their planning synchronized with that of the brigade, and conversely. Aviation and Air Force units can report enemy activity enroute to and from their objectives, allowing IVIS-Plus (for Army Aviation) or manual input of Air Force in-flight reports to the common picture of the enemy situation almost instantly.[63] Similarly, the ADA LNO can alert virtually the entire command of changes in air defense warning and alert statuses, as well as which air space control measures are in effect, almost instantaneously. While many of the Field Artillery benefits described above are already in existence, the marriage of AFATDS to MCS will permit all staff elements' information to be rapidly shared between all the effected staff sections, improving coordination and understanding of the total

picture. Once all components are fielded, the ability to share near real time information with significantly reduced manual manipulation of data will free the staff to digest and draw conclusions from the torrent of data that these new systems will bring with them.

The common thread that runs throughout the near term modernization program is the common picture capability of the system. This is a key first step to getting all parties operating off a near real time, common database, allowing common decisions to flow from a common understanding of the battlefield. Because "distributed decision making depends on each decision maker being able to perceive situations similarly...",[64] this is an essential element to the Army's 'centralized planning, decentralized execution' command and leadership philosophy. But while the system will track units, terrain management, systems, facilities, and supplies, any assessment of their impact on operations must still be determined manually. These systems provide relatively little assistance to the staff to help them assimilate or manipulate this vast array of data. Whether these new, graphics-reliant processors will fully keep pace with the impending increase in the volume of information has yet to be determined. A force projection strategy that could find the brigade's rear in CONUS while it is committed to operations in-theater, all the while supported by decreasingly experienced staff personnel, is a daunting challenge.

The second common quality shared by all of the functional subsystems is their ability to track the CCIR, albeit in a predominantly manual mode. This begins to get at the heart of what an

automated, user-friendly, C2 system is about, helping the staff to assist the commander make rapid, intelligent decisions.[65] The marking of CCIR triggers on the common picture display will raise the consciousness of their impact throughout the force, if they are turned on or are tied to a physical object. But the system will do nothing to alert commanders or staffs of situations that are not on the screen at the time, or involve comparisons between friendly forces, enemy forces, terrain, and time.

Ironically, many of the Functional Subsystems, AFATDS, CSSCS, and FAADC3I, are further along in the development process than the unifying component, MCS. Because MCS is the single element that everyone will have access to, it remains the centerpiece of ATCCS at the brigade level. Consequently, any new efforts at improving overall staff efficiency must in large part be addressed by MCS. The battle staff's ability to meet that challenge will depend on how well MCS in the years beyond ATCCS Block III improves their efficiency. In the interim, the near-term battle staff will be supported by a system that can move, aggregate, display, and record data, but shed little light on what it means or how to compensate for shortcomings. How that challenge might be met is addressed below.

IV: Integrating Automated Normative Analysis Into ATCCS Block IV MCS

This section offers a solution to the shortcomings of ATCCS Block III. The solution is described as ATCCS Block IV, as that

represents the next evolutionary development of ATCCS. But the thrust of this section is on what ought to be, not a prediction of what is currently planned. Indeed, two of the most promising decision aids, the Course of Action Analyzer and Movement Control Program were deleted in the latest ATCCS Block IV deliberations, clouding their future.[66] The following analysis argues that these are the capabilities that should be pursued, and that they are within reach.

The critical shortcoming of ATCCS III MCS, IVIS-Plus and C2V is that they are a nearly zero-sum equation with regard to the battle staff's workload. The increased efficiency of handling data is roughly offset by the considerable increase in the sheer volume of information to be confronted. While the commander needs clarity and synthesized data to free him to focus on a few critical decisions, the staff must deal with the myriad details, for it is within those details that reality resides. The spartan, less experienced staff of the future will be expected to handle increasingly complex control problems of far greater scope and at faster speeds than have been required heretofore.

The quality of decisions, degree of imaginative thinking, and emotional energy that most staffs are able to sustain under long periods of stress and fatigue are limited.[67] These faculties are degraded all the more rapidly by having to solve complex computational problems and other routine functions as the staff proceeds through the decision making process. Especially under time stress, staffs generally do not consider multiple options, or compare these options effectively if they do consider them. Their natural

reflex is to respond to given situations with personally or unit-preferred responses.[68] Under stress or uncertainty, decision makers rely more on intuition than objective analysis.[69] Their decisions are usually made based upon recognizing existing situations as instances of things they are familiar with from previous experience.[70] While these 'automatic' responses are appropriate to an instantaneous battle drill at the lower tactical levels of platoon and company, it should be the option of last resort for a brigade battle staff. Reliance on this kind of decision making is an indicator that the staff has failed to see the battlefield, and has let the enemy seize the initiative.

Staffs are most likely to make effective decisions if they combine solid doctrinal expertise, supported by the necessary information on demand.[71] The solution is aggressive use of automated normative analysis (ANA) to free the staff from even more of the rote, computational or complex comparative analysis that ATCCS Block III will leave them executing manually.

ANA is the process in which computers calculate quantifiable problems, make comparisons based on predesignated parameters, then offer recommendations to achieve the best result according to the decision criteria provided by the commander and staff. The current capabilities of automation also allow ANA programs to formulate simple plans for operations that are essentially quantitative analysis problems. Comparing and recommending require that norms or standards be applied. Norms are nothing more than yardsticks or rules of thumb with which to measure degrees of risk or effectiveness.

Using norms developed by the Army and amended by unit experience, current automation can extract current operations data, or postulated future operations data, and compare it to: the factors of METT-T (Mission, Enemy, Troops, Terrain, and Time); unit Standard Operating Procedures (SOPs); and theater rules of engagement (ROE).[72] The results of these comparisons highlight units or plans operating outside of norms or limits. Interactive comparison of plans versus METT-T will yield wargaming results, with a dynamic portrayal of action-reaction-counteraction.

Using ATCCS Block IV MCS and the other FSS software configured to these specifications, the staff can more quickly execute the decision making process. During continuous operations, the automation will be less error-prone than the staff.[73] Additionally, the staff will now be partially freed from the cognitive and physical workload of calculation, data research, and routine comparisons, allowing them to orient on the issues requiring intuition, judgement, creativity or leadership. During periods of stress, leaders tend to have difficulty with situation and information assessment. They tend to focus on a single enemy course of action, and prepare responses only to that threat.[74] This is a key point to incorporating automated normative analysis. The machines make no decisions, they perform calculations and comparisons and make recommendations based upon the parameters established by the commander and staff.[75] But their impact is to allow the Command Group perform the intuitive and judgmental tasks faster, more creatively, and with greater precision.

ATCCS Block IV MCS can impact on all three elements of the

staff responsibilities: situational tracking, operations planning, and operations execution. We will use these three divisions to examine how a Block IV MCS model can improve staff performance in the narrative description below. The specific impacts on the tasks and subtasks performed by each staff element are found in Annex B. The Annex B analysis of ATCCS Block IV MCS is strictly the author's own, as no solution has been agreed upon by the Army.[76]

Situational tracking refers to monitoring events, facilities and units, and comparing them against an expected or desired standard. Because Block III MCS is primarily oriented on this tracking function, this is the element least effected by Block IV. The new system will improve upon Block III MCS by automatically alerting the staff of impending suspenses, changes to critical assets (bridges, routes, communications nodes), unit expenditures and status, and overtasking units. The difference lies in the analytical ability of the upgraded MCS to detect if a damaged bridge is on an MSR or priority route, or if it is on a nonessential road. If the former, it must automatically alert the proper staff officers' terminals in a clear and unambiguous way, regardless if their terminals have that program displayed or not. Similarly, if enough of a critical asset that is required for a subsequent operation is damaged to the point that the task can no longer be performed; perhaps Mine Clearing Line Charges (MICLIC) for a breaching requirement, the system must alert the commander and staff to this fact. The key difference between the near and long term systems is that the latter understands the implication of a unit status report,

it does not merely compile, transmit, and file it.[77]

The second staff function, planning operations, is the most amenable to ANA assistance, because the staff is nearly always planning, and the analytical requirements are increasingly burdensome. The most critical need is for a Course of Action (COA) wargaming capability. This requires the program to superimpose current or proposed friendly and enemy courses of action and their forces onto the TEM terrain module, then execute both schemes of maneuver using the action-reaction-counteraction methodology according to parameters established by the S2 and S3. The machine is executing a more detailed and scientific analysis of the standard wargaming technique in use today. The difference is that it is able to factor many more variables faster and more accurately than people, and can then store them for future comparisons and playback. Replacing the largely subjective analysis of the staff with an objective computer analysis provides a start point for the staff to exercise judgement, imagination, experience, and intuition. The product will be suggestive and descriptive, not predictive of the proposed action. By operating off previously identified norms for unit performance, the system will be able to highlight loss rates, success or failure potentials, culminating points, and areas where greater or lesser force needs to be applied. The staff must use this as a guide, much as their own manual wargaming is a guide, not a guarantee. During graphic playback, the staff must analyze the computer's comparison to see if they concur, or wish to override.

The dynamic graphic results of the wargame can be transmitted

to the commander even if he is in another CP for his approval and so that he can update his CCIR and intent if necessary. If the dynamic wargame display is satisfactory, he can use it to illustrate his intent with a clarity far beyond that of the written paragraph.[78] The speed, accuracy, and playback features of this program will play a large role in freeing the staff to focus on coordinating the final plan, thus giving more time to subordinate units to prepare.

Once a COA has been selected, a similar process is used to synchronize the plan. In essence, the system rewargames discrete events in greater detail as the staff inputs factors and establishes parameters. The system keeps track of projected losses, terrain control, supporting arms positioning and ability to support, and prompts the staff to fill in the blanks. For example, if Air Interdiction or Close Air Support is required for a specific fight, Block IV MCS prompts the S3 Air to request air within the proper Air Tasking Order (ATO) request window, plan for observation of the expected target, plan to change the air defense status, and plan for suppression of air defenses. If MCS anticipates that a unit will become ineffective or lose a critical asset, (i.e. bridging or breaching equipment), it alerts the staff to this potential, and offers alternate resources. It is then up to the staff to accept this result and compensate for it, or reject it. The resulting synchronization matrix will be compiled by MCS automatically. In compiling the matrix and the plan, MCS monitors the coordination of key events. Who is observing a specific Named Area of Interest(NAI)? Is a given obstacle observed and effectively covered with direct and

indirect fire? If the dedicated asset has not been identified or can not execute the mission from the assigned position, MCS alerts the staff. The staff must now override based on ground truth that the computer can not see, or else correct the deficiency. Like the wargame, the synchronization matrix and decision support template can be forwarded to the commander for approval or modification.[79]

With the approved order and matrix, the staff can complete the order or plan. Using Block III touch screen pens, a large monitor and screen-text interface, the staff can rapidly move from graphics to text. ATCCS Block IV MCS transfers the grid locations of: units, CPs, targets, obstacles, NAIs, routes, release points, contact points, and coordination points directly from the screen to the preformatted OPORD text without manual interference. If there is a conflict with previously input data, or if there is a terrain management conflict, MCS alerts the staff. The screen should be large enough to display the brigade's area of operation in 1:50,000 scale either directly off the screen or projected onto a transfer surface so that map overlays can be produced straight from the computer without interpolation.[80] During OPORD preparation, MCS alerts on terrain management conflicts both before and during operations. Dynamic graphic portrayals of the commander's intent and concept of operation can be transmitted to all MCS equipped recipients, improving understanding.

ATCCS Block IV MCS is capable of devising simple plans to solve routine, quantitative analysis intensive tasks. Mating TEM databases with current unit statuses, and a mission to move the brigade to a

designated assembly area, MCS could identify the best mix of routes and units based on unit SOPs, terrain, and movement restrictions, then print out the proposed march tables.[81] Similarly it can: optimize reconnaissance and security assets, Host Nation Support resources, alternate routes and bypass options, deconflict terrain, propose future communication nodes and target acquisition battery sites to support the brigade, optimize Weapon System Replacement Operations (WSRO) pairings, deconflict refugee routes and facilities from military forces', and predict engineer material availability versus needs over time. Many of these capabilities have already been individually demonstrated. They remain to be joined into a package that can perform many functions at the behest of the staff.

Finally, Block IV MCS assists the planning function by running comparative analyses of planned operations versus norms versus current or projected data and alerting the staff when demands are calculated to exceed resources. Much of this function will serve the Administrative-Logistics staff in proactive resupply or prestockage, but it will also serve the operations and supporting arms elements by permitting them to consider alternative solutions. A prime example of this analysis would be to compare doctrinal norms of artillery ammunition expenditure to achieve the commander's stated intent for fires against the Required Supply Rate (RSR), Controlled Supply Rate (CSR), and on-hand stockage and transportation capacity. If the norms required to fulfill the commander's plan exceed the other figures, the staff must be alerted so that an adjustment can be made. Another example would be for MCS to recommend requesting divisional, corps,

or adjacent unit assets known to be in position to cover NAIs or targets that exceed the brigade's capability. MCS should make these calculations across the entire spectrum of Battlefield Operating Systems (BOS). Risk assessments, passive ADA coverage, Rules Of Engagement (ROE) violations of considered COAs, target value analysis, gap crossing options, and recommended solutions for higher echelon support for problems unsolvable within the organic capacity of the brigade are prime opportunities for comparative analysis.

The third function of the brigade staff is to supervise execution of the operation and adjust to meet unforeseen circumstances and opportunities. This begins even in the planning phase, when branches and sequels are developed and transmitted. As the battle develops, the staff uses the wargamed COA, branches, and sequels to ensure that the operation is on track. If assets are lost at unexpected rates, enemy responses are not as expected, or if force ratios are not maintained as expected, the staff will be able to rapidly rewargame the new situation using real time data, or test branches against the new conditions to see if they offer a better option. As assets are used at higher than expected rates or if a critical asset is lost, Block IV MCS will alert the staff that a decision must be made. As the battle unfolds, and the commander's CCIR is answered, MCS will alert the staff so that the intelligence puzzle can be fit together as rapidly as possible.

Just as the Block III MCS was not without additional burdens to the staff, namely balancing information processing speed against a huge increase in information to process, so too does Block IV MCS

impose an additional burden. That burden is three-fold. First, the staff must ensure that the parameters or norms it imposes on the ANA decision making process are appropriate. These parameters must be adjusted as experience reveals new conditions in various theaters and against new enemies.[82] Secondly, the staff must always guard against taking the computer's analysis at face value. Every recommendation must be examined, however briefly, with a judicious eye. No COA wargame or alert can go unchallenged, and never can the computer's 'optimized' COA be accepted because the computer is regarded as infallible or superior to human judgement. Block IV MCS is no less a slave to man than the hand held calculator, acetate covered map, or grease pencil.[83]

Finally, ANA will cause the staff to approach its tasks in a more analytical manner. Many officers and NCOs whose current duty descriptions involve analysis and judgement actually spend much of their time posting maps, updating charts, and searching for data. Block IV MCS reduces these burdens, but also demands that they display higher order analytical skills, now that they have the time and resources. This represents a considerable culture shock, and will cause us to alter our battle staff training programs accordingly.[84]

The astute reader will observe that the ATCCS Block IV-equipped staff is not doing anything not currently required by doctrine. This is our intention, not to alter the staff's contribution, just to make it faster, more reliable, and more expansive in its thinking. This increases the speed with which a unit can gather information, evaluate it, plan, and execute the plan. This

will pay dividends in longer preparation times for subordinate units, better orders and plans, more responsive support, and greater attention to detail in responding to unforeseen circumstances.

Such a radical change from the brigade staff procedures the Army has lived with for the last seventy years will not go unchallenged. Those who have grown of age with the manual system, or who have had a poor initial experience with MCS, may naturally resist this bold leap into the electronic age. Four of the most common objections to radical automated normative analysis are addressed in Section V.

V: Common Concerns With Automated Normative Analysis-Assisted Command and Control.

One of the primary counterarguments to introducing ANA into combat CPs is the concern that an overreliance on technology will degrade staffs' and commanders' skills; that they will only be able to operate around the computer, not through it. The tyranny of the machine and the inevitable statistical and normative values it relies on will override the judgement of the unit's uncritical and unlearned leaders, who will become slaves to the system, much like our cherished caricature of the old Soviet commanders. The fear is that computer solutions will gain a moral authority that commanders and staffs will reject only at their risk.[85]

This is a valid concern, and one that must be addressed in the institutional and unit education of the officer and NCO. Primary

emphasis must be placed on learning the decision making process and the analytical steps to evaluate battlefield conditions. Officers receive initial training in the Advanced Course, which normally precedes their assignment to brigade staffs. Combined Arms and Services Staff School (CAS3) and Command and General Staff College (CGSC) reinforce the process. Undoubtedly, instruction would mature over time to include ANA systems, but the primary and initial focus must remain on the conceptual knowledge of how the system works, not the machines.

The second means of countering this problem is to insure that prompts and recommendations are phrased in a questioning way that reinforces the master-servant relationship between commander or staff and the computer. Using menus of options instead of a single prompt will also help the user retain his perspective on his dominant role, and how the process works. When COA wargame results are presented, they must include a percentage confidence factor, and a list of critical assumptions that the user input or the computer used in its calculations. A sample result might read:

> "Given that the enemy is at 70% strength (**ASSUMPTION**), and that CAS is available as projected, and that the lead task force retains 95% combat power **(ASSUMPTION)**, then there is an **80%** chance that TF X will defeat the Y MRR."

Imbedding all of these factors will force the user to adopt an active and directive relationship towards the machinery, and prevent him from passively accepting its output.

Finally, the unit commander will set the tone of how ATCCS IV MCS is treated. It remains his responsibility to continue training

plans and test scenarios to develop his unit's skill in battle C2 and understanding of the man-machine relationship.[86] Command is still an art and will remain so for the foreseeable future. The computer can not replace man's intuition, hence it must remain only a tool.[87]

The second challenge to the ANA model is that it is inherently fragile, unable to withstand the rigors of long term campaigning. The reliance the staff will be able to place on the system will be so low that it becomes a worthless impediment. A variation on that argument is that its fragility will force the equipment to be pampered and kept well back from the violent maneuvering at the line of contact. Consequently, the staff will lose the opportunity for first-hand observation of events, and see war only through computer icons.

This is another valid and well-deserved concern. Early models of electronic decision aids have suffered from these defects, with both of the postulated results occurring.[88] ATCCS IV MCS and the C2V program provide a very robust redundancy package, in which no less than four C2Vs, perhaps as many seven, will be equipped to process MCS with ANA capability. Indeed, the demands of continuous operations dictate that some machines will frequently not be operating except to receive data and update databases and plans while the crew sleeps at their stations. But regardless of the built in redundancy, the equipment must not be fielded until it is mature enough to perform reliably in austere and severe conditions. The history of all new equipment is that it usually suffers teething pains in its early versions, but that these are eventually sorted out. Imagine the M1A1 Abrams Battle Tank without its on-board computer, thermal sights,

laser rangefinder, and engine monitors. It would take a very severe challenge to national interests to provoke the Army to fight against a modern armor threat without these capabilities. Yet all of those systems are computer driven and operate very well in a much dirtier environment than the C2V. Finally, FM 101-5's enjoinder that commanders must back up all automation systems with well maintained manual ones is as true for MCS as it is for the hand calculator.[89]

The third concern relates to how the commander personally responds to the ANA capabilities of MCS. He might he be tempted to withdraw from his forward position to a site more conducive to CP operations. He might believe that he could see the battlefield and manipulate his forces better from the serenity of a secure CP with a large screen monitor than in his combat vehicle with a downlink. The effect might be reminiscent of the 'Chateau Generals' of World War I. Conversely, brigade commanders may be tempted to tinker with the actions of squads and platoons, now that they can 'see' them via ATCCS.

The potential for this kind of behavior is created by ATCCS Block III MCS, which is already programmed for procurement, not by the ANA capacity of MCS. The common picture feature raises these problems, and is not really enhanced by the proposed Block IV model. The commander would be able to manipulate the ANA supported wargame and analysis functions from his TAC as easily as from the TOC. All of the factors that would drive a commander to leave the forward position or unwisely meddle with subordinates are present with or without ANA. ANA is a only staff officers tool to speed and improve

his performance of traditional duties. The commander incurs no additional benefit from absenting himself from the battlefield. The astute commander will use ANA-enhanced wargaming to help him decide where he needs to be at various stages of the battle to best influence the fight. In any event, the art of battle command is as much personal leadership as tactical manipulation. The Army must continue to stress the value of the commander's presence at the critical place and time regardless of the luxuries of a fully automated CP.

Electronic Counter Measures (ECM) and friendly electronic fratricide are the fourth and final serious objections. Once again, ATCCS Block III and IVIS-Plus, which are already programmed and in testing, will paint the same electronic signature as ATCCS Block IV. The addition of ANA is an internal staff tool, which might conceivably reduce the inter-CP communications of ATCCS Block III. The capability of ANA to create simple plans based on current or projected databases may eliminate some querying, coordinating and confirming electronic traffic between C2Vs within the moving TOC, and between CPs. Because ANA is an internal staff tool, its analytical and simple planning capacities will not be effected by ECM other than Electromagnetic Pulse, which will obliterate the entire Electromagnetic Spectrum in any case. Consequently, ECM will not effect ANA directly. ECM might tremendously effect IVIS-Plus, and thereby reduce the real time common picture capability of both Blocks III and IV, but ANA will still permit manual inputs, and be able to analyze current and future plans, as well as perform simple planning

as before. In fact, it would appear that ANA is more resistant to ECM than IVIS-Plus or the common picture qualities of Block III MCS.

VI: Conclusions

The focus of this monograph was to explore the long term future of automated command and control systems for the heavy brigade battle staff. Starting with an examination of the effects of Post Cold War Army personnel policies and current data transmission capabilities, it raised the potential for data and task overload for the staff.

This problem is created by new personnel policies that limit brigade staff officers to one year on the primary staff, and virtually preclude command qualified captains from serving on the brigade staff. The need to fill non-TOE slots elsewhere in the Army also keeps officers from sequential TOE assignments as captains and majors, so that primary staff officers will frequently join their command having been absent from troops for an average of five years. Based on these conditions, the paper postulated how the brigade staff would be organized, operate and be equipped in the near future under three modernization programs: IVIS-Plus, ATCCS Block III, and C2V.

Data floods into the brigade CPs at an unprecedented rate, and covers a scope of operations rarely encountered by brigade staffs to date. Near future improvements in technology will increase this spate of information beyond the ability of the already heavily taxed staff to manage. In addition to the echelons above brigade intelligence that are to be funneled to the brigade, the Army is exploring the

capabilities of IVIS-Plus, a semi-automated information system that will automatically report soldier, combat system, and combat support/service support system status to its higher headquarters. This information will be aggregated at each echelon and passed to higher and adjacent units, along with enemy activity.

ATCCS Block III MCS is the Army's solution to handling this problem of information overload. It improves data handling and performs rudimentary analysis culminating in a graphic common picture of the battlefield. This common picture will be passed around the battlefield CPs via MCS and to the combat and support systems via IVIS-Plus. Staffs, operating from highly redundant and interdisciplinary C2Vs, will be able to manipulate the displays of this data to present exactly the combination of information necessary to make decisions and to paint the desired picture.

Block III MCS allows the staff to manually manipulate the information into manageable arrays, but still requires that the data be manually analyzed, aided by the calculator functions of MCS and the other ATCCS Functional Subsystems. Whether or not Block III MCS and the other modernization programs can keep pace with the increased information remains to be demonstrated. The requirement to process this data during sustained, continuous operations by a staff that, by definition, has been on the job or served together for only a short time is an unacceptable risk.

The integration of automated normative analysis was offered as a long-term fix to this problem. Using the same staff configuration and missions as in the near future projection, the addition of ANA

allows the staff to wargame relatively complex actions faster and with greater accuracy. The staff inputs the parameters of the battle and adjusts the default norms as dictated by their own experiences in theater. Using these factors, or current data, ATCCS Block IV MCS performs the METT-T and action-reaction-counteraction analysis for friendly and enemy units. Using triggers, alerts, unit SOPs, higher headquarter's restrictions and ROEs, the computer suggests the result of the battle. It plays back the results for the staff to analyze and evaluate, modify, accept or reject based on their experience and judgement. This dynamic picture of the battle is passed to the appropriate commanders and staffs to paint the commander's intent or scheme of maneuver. Branches and sequels are similarly wargamed and filed for future use. During the battle, the staff updates the wargame to detect any shortcomings based on reality.

The ANA capacity will actively alert the staff to status changes of critical systems, facilities, or conditions. CCIR items, or decision point thresholds will be similarly recommended by the computer and alerted on once they are triggered. The staff and commander remain the final arbiter of all decisions and parameters for the computer to operate under. Indeed, the first step of examining the computers recommendations and analysis must be to challenge the assumptions and validity of the output. In other words, "Does this make sense?"

Finally, ANA will create simple plans for operations that are largely governed by quantifiable factors and unit SOPs. Road marches, maximizing transportation, fire support and intelligence gathering

resources are examples of this. The staff will modify, reject or accept the plans based upon their judgement.

The advantages of ATCCS Block IV MCS are that it frees the staff from focusing on rote, tedious, repetitive calculations. This is especially useful when the staffs and commanders are fatigued or under stress. They can now focus their attention to devising courses of action, performing the human elements of leadership, actually executing a realistic rest plan, and analyzing the flow of the battle instead of computing force ratios, movement rates, and fire units.

The monograph concluded by examining four common objections to injecting ANA into the brigade command and control process. The conclusion is that all of the system's physical frailties and ECM vulnerabilities are no more prevalent in Block IV MCS than in Block III, which is upon us in any case. Fears about the abdication of responsibility to the machine, or blind acceptance of norms by the staff are well founded. These must be addressed by the manner in which the machine phrases its recommendations and by institutional and unit training.

The Army and the world are moving into the information age where machines will replace the manual manipulation of information and routinely analyze the database. As war becomes increasingly complex and covers a greater scope, the control of operations must keep pace. ANA is the next reasonable step in this evolution, and its fundamental role in our C2 system must be defined early on if the Army is to remain at the command and control cutting edge.

ANNEX A: The Brigade Staff and Command Posts.

The diagrams below portray the current configuration of the doctrinal Brigade CPs and the proposed C2V CPs. Because neither doctrine nor the C2V Concept paper dictate where all personnel operate from, the author has taken the liberty to position staff members in logical locations. The number of personnel allocated to each configuration remains faithful to the authorization documents available. The supporting unit commanders and Air Force LNOs that would ordinarily be present at the Command Group or the other CPs have been omitted as they are not referenced in either document. The TOE Handbook for the Current CP configuration also omits the ADA and Aviation LNOs that would ordinarily be present, though the C2V Concept Paper includes them. In order to keep an even presentation of personnel strengths, both CP variants include these positions.

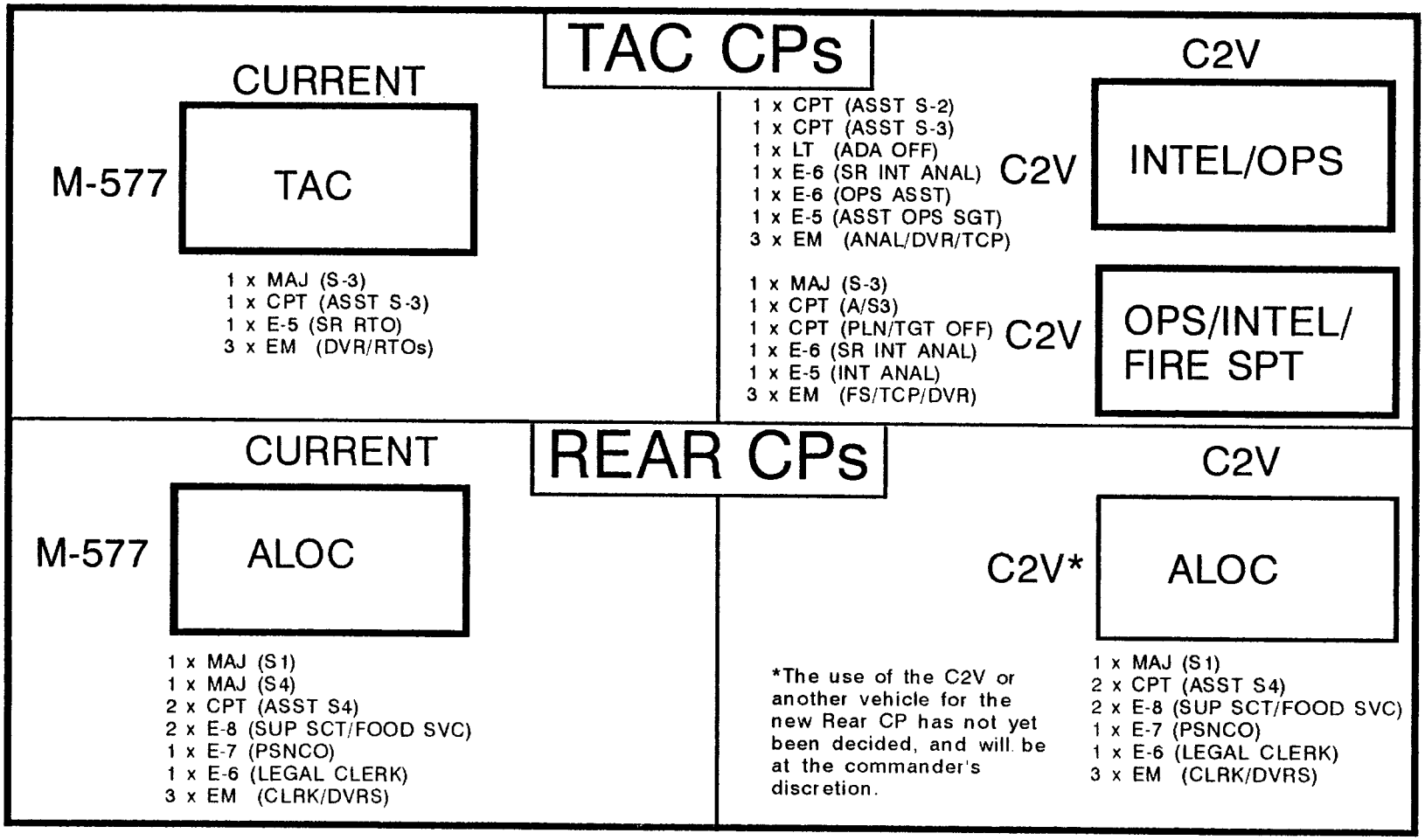
COMPARISON OF PERSONNEL STRENGTHS

	CURRENT				C2V			
	TAC/CG	MAIN	REAR	TOTAL	TAC/CG	MAIN	REAR	TOTAL
COL	1			1	1			1
LTC		1		1		1		1
MAJ	1	2	2	5	1	3	1	5
CPT	1	7	2	10	4	7	2	13
LT		2		2	1	2		3
E-9		1		1		1		1
E-8			2	2			2	2
E-7		4	1	5		2	1	3
E-6		3	1	4	3	3	1	7
E-5	1	1		2	2	3		5
EM	4	16	3	23	7	6	3	16
	8	37	11	56	19	28	10	57
	(3/1/4)	(12/9/16)	(4/4/3)	(19/14/23)	(7/5/7)	(13/9/6)	(3/4/3)	(23/18/16)

FIGURE 1.

The table at Figure 1, shows a net gain of one soldier in the new C2V CP configuration, with four more officers, four more NCOs, and seven fewer enlisted personnel. The exact configuration of the C2V CPs has yet to be determined, and will undoubtedly change as the concept is tested and refined. In many instances, precise rank structure has not been assigned to a specific function, so that the numbers of NCOs versus enlisted personnel may fluctuate.

Despite the fact that the C2V staff has one additional person, and is officer/NCO heavy, BCBL regards it as austere because it does not easily accommodate additional personnel. Currently, brigade CPs are frequently overstrength, since the TOE is widely regarded as insufficient. The additional officers, NCOs, and enlisted personnel travel in separate vehicles and link up with the CPs once they are stationary. Because the Main and Rear CPs are virtually mission incapable while moving, the absence of these additional personnel is largely immaterial during the movement. The C2V is designed to operate on the move, though it will operate from the halt when possible. Since the likelihood of the additional personnel being gainfully employed is diminished in the C2V program, BCBL concludes that there will be less incentive to plus up the brigade staff.


TAC CPs
CURRENT
M-577
TAC
1 x MAJ (S-3)
1 x CPT (ASST S-3)
1 x E-5 (SR RTO)
3 x EM (DVR/RTOs)
C2V
1 x CPT (ASST S-2)
1 x CPT (ASST S-3)
1 x LT (ADA OFF)
1 x E-6 (SR INT ANAL)
1 x E-6 (OPS ASST)
1 x E-5 (ASST OPS SGT)
3 x EM (ANAL/DVR/TCP)
C2V
INTEL/OPS
1 x MAJ (S-3)
1 x CPT (A/S3)
1 x CPT (PLN/TGT OFF)
1 x E-6 (SR INT ANAL)
1 x E-5 (INT ANAL)
3 x EM (FS/TCP/DVR)
C2V
OPS/INTEL/
FIRE SPT
REAR CPs
CURRENT
M-577
ALOC
1 x MAJ (S1)
1 x MAJ (S4)
2 x CPT (ASST S4)
2 x E-8 (SUP SCT/FOOD SVC)
1 x E-7 (PSNCO)
1 x E-6 (LEGAL CLERK)
3 x EM (CLRK/DVRS)
C2V
C2V*
ALOC
*The use of the C2V or another vehicle for the new Rear CP has not yet been decided, and will be at the commander's discretion.
1 x MAJ (S1)
2 x CPT (ASST S4)
2 x E-8 (SUP SCT/FOOD SVC)
1 x E-7 (PSNCO)
1 x E-6 (LEGAL CLERK)
3 x EM (CLRK/DVRS)

CURRENT MAIN CP

1 x LTC (XO)
1 x CPT (A/S-3)
1 x E-9 (OPS SGT)
1 x E-7 (A/OPS SGT)
1 x E-6 (SR RTO)
3 x EM (RTO/DVR)

1 x MAJ (FSO)
1 x CPT (TGT OFF)
1 x E-7 (BDE FS SGT)
2 x EM (FS ANALYSTS)
1 x EM (DVR)

M-577 S-3 OPS | M-577 FSE

S-2 M-577 | ABE M-577

1 x MAJ (S-2)
2 x CPT (A/S-2/TAC INTEL)
1 x E-6 (SR INTEL ANALYST)
1 x E-5 (INTEL ANALYST)
5 x EM (INTEL ANALYSTS)
1 x EM (DVR)

1 x CPT (ABE)
1 x E-7 (OPS SGT)
1 x E-6 (A/OPS SGT)
2 x EM (RTO/DVR)

ELEMENTS THAT REMOTE INTO MAIN CP
1 x CPT (AF LNO)
1 x LT (ARMY AVN LNO)
1 x LT (ADA LNO)

S-3 PLANS/ JUMP CP M-577

1 x CPT (A/S-3)
1 x E-7 (NBC NCO)
2 x EM (RTO/DVR)

The Current Brigade Main CP must stop and colocate to perform virtually all of its major functions, other than monitor the radio. Because each staff element is segregated in its own vehicles, there is little opportunity to coordinate or synchronize on the move.

C2V MAIN CP

C2V OPS/INTEL

1 x LTC (XO)
1 x MAJ (S-2)
3 x CPT (ASST S-3/S-3 Air/Chem)
1 x E-9 (OPS SGT)
1 x E-6 (NBC NCO)
2 x EM (TCP/DVR)

C2V FSE

1 x MAJ (FSO)
1 x CPT (TGT OFF)
1 x LT (ADA TAC OPS)
1 x E-7 (BDE FS SGT)
1 x EM (DRIVER)

INTEL PLUS C2V

1 x MAJ (S4)
1 x CPT (TAC INTEL)
1 x CPT (AVN LNO)
1 x E-6 (INT SGT)
3 x E-5 (INT ANAL)
2 x EM (CLERK/DVR)

ENG & OPS C2V

1 x CPT (ABE)
1 x LT (ADA LNO)
1 x E-7 (OPS SGT)
1 x E-6 (CONST FORM)
1 x EM (DVR)

The C2V based Brigade Main Command Post will operate in three basic modes: moving, short halt, and long-term stationary. Crossleveling functional areas, and operate on the move capability will allow the staff to continue to operate, with modest degradation, while keeping up with the brigade. Even if it becomes impossible to operate the computers to full capacity, the staff can still coordinate because of crossleveling. The vehicles are shown here in the dispersed travelling mode to highlight the worst-case operation.

ANNEX B: Functional Analysis of ATCCS Impact on Brigade Staff

The analysis presented below is a subjective assessment of how automation and the other modernization programs discussed in Section II will impact on the doctrinal tasks required of the brigade staff. Staff elements are arranged into the same groups as in Section III, for ease of tracking. These groups are: Special Staff, Administrative-Logistics, Operations-Intelligence, and Supporting Combat Arms.

The baseline data and analytical techniques are extracted from the Battle Command Battle Lab's (BCBL) Command and Control Vehicle Final Draft Operations Concept Staffing, Appendix D. This document compares the impact of automation on the current staff and the C2V/ modernized ATCCS equipped staff. FM 71-3-MTP, Mission Training Plan for the Heavy Brigade Command Group and Staff, is the source of the doctrinal requirements.

The author then applied the same analysis to the brigade staff equipped with the automated normative analysis enhanced system proposed in Section IV. Staff elements found in FM 71-3-MTP that are not functionally analyzed in the C2V document have been assessed by the author for current, ATCCS Block III and ANA-enhanced Block IV.

The basis of the functional analysis for current operations is objective. The BCBL can test the performance of the current staffs workload. Their projection of Block III is more subjective, in as much as the system as a whole will not be fully tested for several years. The author's analysis of ANA-enhanced Block IV is

even more subjective, as these technologies have yet to be tested in practical field application. While the technologies exist and have been applied to military wargaming and decision making, the Army is still working only on their conceptual applications.

The following codes are used to describe the results of the functional analysis:

M--Manual. Tasks require personal contact, or manual data input/analysis. Automation has negligible impact on these tasks.

A--Automated. Significant portions of these tasks can be speeded or assisted by use of automation. Automation refers to receiving, filing, sorting, rough aggregation and presenting data. Virtually no analysis is performed.

SA--Semi-automated. Some functions embedded in other applications may be of use to the staff, but the system remains largely manual.

ANA--Automated Normative Analysis. Application is able to test courses of action established by the staff, under norms, parameters and procedures that the staff controls. System is able to create simple plans that are almost exclusively dominated by quantification skills. System tracks the execution of these operations to alert on failure to achieve necessary conditions as established by the staff. ANA recommends

options to bypass problem.

#--Author believes that C2V functional assessment understates the impact of automation on the task, and should be upgraded.

*--Author believes C2V functional assessment overstates impact of automation and should be downgraded.

~--Author's assessment is that ANA or a spinoff quality will improve the performance of the task, but the task retains its Block III status.

NC--No Change. Task retains basic Block III features.

++--Tasks not evaluated by BCBL. Author rated these tasks against all levels of automation.

Each subtask is evaluated against the standards specified for that subtask in FM 71-3MTP. These standards have not been listed because there are several thousand of them, but each subtask's amenability to ANA and automation was evaluated based on these specific standards. Consequently, subtasks with identical names may have different standards, hence be rated differently. To determine the exact reason requires the reader to research the standards for those tasks in FM 71-3MTP. This accounts for some seemingly anomalous ratings in the tables below.

FUNCTIONAL ANALYSIS

STAFF SECTION AND TASK	NOW	III	IV	REMARKS
SPECIAL STAFF				
EXECUTIVE OFFICER (XO)				
DIRECT THE STAFF.				
Physically organize Main CP.	M	A*	NC	
Formulate staff procedures.	M	M	NC	
Direct Main CP efforts.	M	M#	SA	Coord on the move.
Ensure LNOs are dispatched.	M	M	NC	
Primary staff advisor to CDR.	M	M#	SA	Cdr-XO coord on the move.
Supervise/coordinate staff.	M	A	ANA	Contact and synch w/o collocation.
Provide staff recommendation.	M	A	ANA	Wargame results to Cdr on the move.
Implement Cdr's decision.	M	A	ANA	Wargame/Planner on the move.
SUSTAIN THE BRIGADE.				
Coordinate vital CSS.	M	A*	ANA	Wargame interface w/ CSSCS.
Ensure supply, maintenance, transport and supply are available.	M	A*	ANA	Wargame/CSSCS/ Planner.
Oversee reorganization/refit operations.	M	M	ANA	Recommend WSRO.
Ensure reorganized/refit units are combat ready.	M	M	NC	
Oversee WSRO.	M	M#	ANA	CSSCS matchup.
S5--CIVIL MILITARY AFFAIRS.++				
PROVIDE CMO INPUT TO ORDERS.				
Develop CMO Annex.	M	SA	ANA	Track refugees and HNS resources.

Prepare area assessment.	M	SA	ANA	See above.
Interpret CMO plan to subunits.	M	SA	NC	
CONDUCT CIVIL-MILITARY OPNS.				
Recommend area CA policies.	M	M	NC	
Maintain close relations w/ other US CMO agencies in AO.	M	SA	NC	Database link w/ agencies.
Support subunits w/ liaison,	M	M	NC	
Liaison w/ local officials.	M	M	NC	
ACQUIRE LOCAL RESOURCES, FACILITIES AND SUPPORT.				
ID local resources, facilities, and support.	M	M	NC	
Coordinate w/ pertinent personnel.	M	SA	ANA	Track resources in database. Prioritize use.
Plan to eliminate civilian interference.	M	SA	ANA	Wargame alternate routes and resources for civilians.
Evaluate plan.	M	SA	NC	Track resources and control by military and civilian forces.
COMMUNICATIONS SECTION.++				
PLAN COMMUNICATIONS SUPPORT.				
Develop communications plan.	M	SA	ANA	Commo LOS/Node placement. Manage terrain.
Prepare commo staff estimate.	M	SA	ANA	Support wargame results.
Prepare commo annex.	M	SA	ANA	Screen to text; deconflict w/ wargame.

COORDINATE COMMO SUPPORT.				
Coordinate w/ brigade staff.	M	A	ANA	Local CP support.
Coordinate radio frequencies.	M	M	NC	
Coordinate COMSEC/SIGSEC ops.	M	SA	ANA	Wargame signal risk. Screen to text.
Coordinate w/ adjacent units.	M	A	NC	
SUPERVISE COMMO ACTIVITIES.				
Supervise ECCM program.	M	SA	NC	
Supervise COMSEC account.	M	M	NC	
Ensure brigade is supported throughout the operation.	M	SA	ANA	Wargame. ANA recommends how to balance assets.
MP PLATOON.++				
COORDINATE MP OPERATIONS.				
Plan MP operations.	M	SA	ANA	Suggest alternate civilian/refugee routes. ID critical points.
Coordinate/supervise MP plan.	M	SA	ANA	Wargame support for critical actions.
CONDUCT EPW OPERATIONS.				
Plan/coordinate EPW/CI collection.	M	SA	ANA	Limited support for size of EPW and threat.
Monitor EPW/civilian detainees.	M	SA	NC	IVIS-Plus/ Common Picture.
Monitor forward collection points.	M	SA	NC	IVIS-Plus.

BRIGADE SURGEON.++				
PLAN MEDICAL SUPPORT.				
Plan Health service support.	M	SA	ANA	HNS; location and echelonment to spt operations.
Prepare medical estimate.	M	SA	ANA	Area analysis; est. support reqmts.
Prepare medical annex.	M	SA	ANA	HNS; Screen to text.
DIRECT HEALTH PRESERVATION/ MEDICAL SUPPORT ACTIVITIES.				
Supervise medical services.	M	SA	NC	Common Picture.
Advise CDR on medical spt.	M	SA	NC	Common Picture.
BRIGADE CHAPLAIN.++				
PROVIDE RELIGIOUS SUPPORT.				
Provide pastoral ministry.	M	M	NC	
Brief Cdr on religious matters.	M	M	NC	
Implement religious support program.	M	M	NC	
Provide religious support.	M	M	NC	
Support battle fatigue treatment.	M	M	NC	
HEADQUARTERS AND HEADQUARTERS COMPANY COMMANDANT.++				
SUPERVISE MAIN CP SUPPORT.				
Supervise Main CP internal arrangement.	M	M	NC	
Provide supplies and services to Main CP.	M	M	NC	

Supervise Main CP maint.	M	M	NC	
Supervise Main CP movement.	M	SA	NC	
Supervise Main CP security.	M	M	NC	
ADMINISTRATIVE-LOGISTICS STAFF.				
S1 SECTION.				
PARTICIPATE IN OPORD PREP.				
Prepare personnel estimate.	M	A*	SA	ANA HNS analysis.
Coordinate w/ other staff.	M	A	NC	
Prepare Personnel portion of OPORD.	M	A*	ANA	COA Analyzer supports loss estimate and spt. plan.
STRENGTH MANAGEMENT.				
Manage strength accounting.	A*	A	NC	
Maintain PSR.	M	M#	ANA	IVIS-Plus feeds aid station/unit data. ANA alerts on shortages.
Unit strength accounting.	A	A	NC	
Prepare periodic personnel report.	A	A	NC	
Supported/supporting unit liaison.	M	M#	NC~	Common Picture.
CONDUCT REPLACEMENT OPNS.				
Coordinate replacement opns.	M	A	NC	
Conduct admin. processing.	M	M#	SA~	Common Picture and wargame on the move.
BY NAME CASUALTY REPORTING.				
Monitor casualty report system.	M	A	NC	

Report casualty information.	M	A	NC	
ESSENTIAL PERSONNEL ACTIONS.				
Manage direst appointment requests.	M	M	NC	
Monitor unit leave policy.	M	M	NC	
Manage leave program.	M	M#	NC	Track R&R distribution.
Congressional correspondence.	M	M	NC	
COORDINATE FINANCIAL SUPPORT.				
Obtain essential finance spt.	M	A	NC	
Evaluate pay service to Bde.	M	M	NC	
PROVIDE ESSENTIAL ADMIN SUPPORT.				
Process correspondence, messages, and distribution.	M	M	NC	
Control publications/forms.	M	M	NC	
Process and control mail.	M	M	NC	
ASSESS SUBUNIT MORALE.				
Process morale indicators.	M	M#	SA~	Auto-inputs data and files automatically.
Monitor morale in brigade.	M	M	NC	
COORDINATE MWR SERVICES.				
Establish MWR program.	M	M#	SA~	MCS network to R&R sites/HNS facilities.
Schedule/coordinate external MWR support.	M	M#	SA~	Same as above.
Provide organic Bde MWR.	M	M	NC	

PROVIDE LEGAL SUPPORT.				
Provide Cdr w/ legal status of brigade.	M	M#	SA~	MCS compiles and formats data.
Assist subunit Cdrs/soldiers.	M	M	NC	
MANAGE AWARD/DECORATION PROGRAM.				
Supervise brigade awards pgm.	M	M	NC	
Admin support to award pgm.	M	M	NC	
ESTABLISH REAR CP.				
Physically locate Rear CP.	M	M#	SA~	TEM allows recon/ commo LOS; ANA deconflicts terrain.
Establish communication.	M	M	NC	
Monitor tactical situation.	M	A	NC	
Sustain future operations.	M	A	ANA	Wargame; HNS spt.
S4 SECTION.				
CONDUCT LOGISTICAL PLANNING.				
Manage logistic requirements.	M	A	ANA	Norm based forecast.
Conduct mission analysis.	M	M	NC	
Prepare log staff estimate.	M	A	ANA	Norm based expenditure; COA wargame.
Prepare plans and orders.	M	A	ANA	Screen to text; deconflict resource requirements.
Supervise logistics staff.	M	M#	ANA	Wargame during execution.

MONITOR BRIGADE OPERATIONS.				
Monitor tactical situation.	M	A	ANA	Wargame evolving impact of logistics and operations on each other.
Monitor CSS personnel situation.	M	A	ANA	WSRO and critical shortfall analysis.
Monitor intel situation.	M	A	ANA	Wargame effects of rear area threat.
Monitor CMO situation.	M	M#	ANA	HNS/Refugee analysis and resources.
TRACK MAINTENANCE AND SUPPLIES.				
Maintain supply status.	M	M#	A	CSSCS/IVIS-Plus.
Maintain operational ready rate.	M	M#	A	CSSCS/IVIS-Plus.
ACTIVATE REAR CP.				
Establish Rear CP.	M	M#	A	Terrain analysis and deconfliction.
Monitor current situation.	M	A	NC	
PLAN TRANSPORT AND MOVES.				
Plan transport and moves.	M	A*	ANA	Simple plans via ANA.
Coordinate transport/moves.	M	A	ANA	Deconflict routes, resources, times.
Supervise transport and moves.	M	M#	A	IVIS-Plus gives real time assessment.
OPERATIONS-INTELLIGENCE STAFF.				
S2 SECTION.				
PERFORM INTEL ESTIMATE.				
Conduct mission analysis.	M	M	NC	

Perform IPB IAW FM 34-1.	M	A	NC	
Participate in wargame.	M	A*	ANA	COA Analyzer.
Analyze concept of opns.	M	M#	ANA	Track assets vs missions/CCIR. Adjacent unit input.
Prepare Inter estimate.	M	A	NC	
PREPARE INTER ANNEX.				
Process subunit R&S Plans.	M	M	ANA	Compare to ensure all tgts/NAIs are covered, alert if not.
Prepare Inter annex.	M	A	NC	
Process/disseminate annex.	M	A	NC	
ANALYZE ALL INCOMING INTER.				
Determine validity.	M	A*	NC	
Determine impact on COA.	M	A*	ANA	Wargame; asset tracking.
MANAGE INTELLIGENCE EFFORT.				
Direct intelligence effort.	M	M#	ANA	Compare assets with use; ANA recommends IEWSE support.
Manage intelligence effort.	M	M#	ANA	Status of targets and collectors.
PROCESS SPECIFIC INFORMATION REQUIREMENTS (SIR).				
Determine SIR.	M	M	SA	Wargame can ID SIR.
Process information.	M	M#	ANA	Compare vs. expectations.
PROCESS COMBAT INTELLIGENCE.				
Process info/inter on the division/bde inter nets.	M	A	ANA	Common Picture/ comparison.

Maintain journal.	M	A	NC	
Maintain current SITMAP.	M	A	NC.	
Determine target potential of information.	M	A	ANA	TVA from wargame.
Impact of information on close operations.	M	A*	ANA	ANA wargames impact from current data.
Disseminate combat info w/i Main CP.	M	A	NC	
Disseminate combat inter.	M	A	NC	
CONDUCT INTELLIGENCE AIR SUPPORT PLANNING.				
Air intelligence support planning.	M	M#	ANA	Collector vs. target evaluation.
Request TAC AIR RECON.	M	A*	NC	
MAINTAIN INTELLIGENCE DATABASE.				
Maintain SITMAP.	M	A	NC	
Maintain Inter workbook.	M	A	NC	
Refine IPB.	M	A	ANA	Incorporate enemy activity to database for future wargame and estimates.
ESTABLISH OPERATIONS SECURITY (OPSEC) DATABASE.				
Obtain OPSEC database.	M	A	NC.	
Develop OPSEC database.	M	A*	ANA	ANA fills out SIT TEMP.
Maintain OPSEC database.	M	A*	ANA	Wargame enemy collectors vs. bde plan.
MONITOR OPSEC IMPLEMENTATION.				
Monitor OPSEC effectiveness.	M	A*	ANA	See above.

Monitor security battle and OPSEC compliance.	M	A	ANA	Determine which enemy collectors can acquire units being hit.
Recommend OPSEC plan adjustment.	M	A	ANA	Incorporate above into action.
PHYSICAL SECURITY PLAN.				
Develop security plan.	M	M#	ANA	Analyze soft, vulnerable targets.
Input to OPSEC plan.	M	A	ANA	Wargame threat.
Process personnel security requests.	M	A	NC	
S3 SECTION.				
DEVELOP OPERATIONS ESTIMATE.				
Conduct mission analysis.	M	A*	NC	
Conduct staff estimate.	M	A*	ANA	WARGAME/COMPARE.
Recommend COA to Cdr.	M	M#	ANA	Dynamic wargame playback.
DEVELOP OPERATIONS ORDER.				
Prepare OPORD and copies.	M	A	ANA	Screen to text; screen to printer; conflict alerts.
Prepare copies.	M	A	NC	
Incorporate all annexes and overlays.	M	A	NC	
MAINTAIN CURRENT SITUATION.				
Monitor conduct of operation.	M	A	ANA	Wargame battle in progress; revise branches and sequels.
Maintain journal and SITMAP.	M	A	NC	

Update opns estimate.	M	A	ANA	Wargame as battle develops, revise as necessary.
SYNCHRONIZE TACAIR.				
Plan TACAIR.	M	M#	ANA	Synch matrix prompts.
Initiate CAS planning.	M	M#	ANA	ATO prompts.
Plan preplanned CAS.	M	M#	ANA	Synch matrix prompts.
Process preplanned CAS.	M	A	ANA	Wargame BDA/effect. Adjust fires/ maneuver.
Plan BAI.	M	M#	ANA	Same as above.
SYNCHRONIZE FIRE SUPPORT.				
Integrate fire support.	M	A	ANA	Wargame.
Incorporate FS into OPORD.	M	A	ANA	Screen to text; deconflict missions, taskings and locations.
INTEGRATE ENGINEER SUPPORT.				
Integrate engineer support.	M	A	ANA	Wargame effect and resources, ensure observed and covered by fire.
Integrate engineer plan into OPORD.	M	A	ANA	Synch targets/obst. and observers. Screen to text.
SYNCHRONIZE ADA INTO PLAN.				
Integrate ADA.	M	A	ANA	Wargame.
Coordinate ADA movement.	M	M#	ANA	ROE/passive ADA analysis. SEAD control. Wargame.

SYNCHRONIZE DEEP/REAR OPERATIONS.				
Integrate deep opns into bde scheme of maneuver.	M	M#	ANA	TVA; tgt-observer pairings.
Coordinate deep operations.	M	M#	A	IVIS-Plus, IEWSE input. ANA w/ SEAD coordination.
Integrate rear operations.	M	M#	NC	Common Picture; terrain analysis support.
Coordinate rear operations.	M	M#	ANA	Common Picture; wargame; track critical assets.
COORDINATE IMMEDIATE CAS.				
Evaluate CAS and JAAT request.	M	M	ANA	Wargame.
Process requests.	M	A	NC	
PREPARE FRAGO				
Initiate FRAGO prep.	M	M	SA	Common Picture.
Prepare FRAGO.	M	A	ANA	Screen to text.
COORDINATE ARMY AVIATION.				
Integrate Army Aviation.	M	M#	A	Battletrack; Common Picture.
Coordinate FS for OPCON Avn.	M	M#	ANA	Wargame; synchronize support.
Assess aviation employment.	M	M#	A	Common Picture.
Oversee aviation employment.	M	M#	ANA	Wargame; synch opns.
EXECUTE A2C2 IN BRIGADE AREA.				
Establish A2C2 element.	M	M	NC	
Perform airspace management.	M	A	ANA	Wargame; fire/avn deconfliction.

Coordinate A2C2 measures.	M	A	NC	
INCLUDE A2C2 ANNEX IN OPORD.				
Develop A2C2 Annex.	M	A	NC	
Prepare staff estimate.	M	A	ANA	Wargame; fire-avn-inter deconflict.
Develop A2C2 Annex.	M	A	ANA	Screen to text.
IMPLEMENT OPSEC.				
Coordinate databases w/ S2.	M	M#	SA	Enemy Inter LOS/ range fans to US assets.
Develop EEFI.	M	M	NC	
Evaluate operational risk.	M	M#	ANA	Profile US vs. enemy.
Conduct risk analysis and select EEFI.	M	M	ANA	Wargame specific risks.
Implement/evaluate OPSEC.	M	M	NC	
Prepare OPSEC Annex.	M	A*	NC	
REACT TO ENEMY NBC ATTACK.				
Analyze impact of NBC attack.	M	A	ANA	Wargame attack; decon; degradation of US forces.
Make recommendation for future operations.	M	M#	SA	Terrain analysis for decon.
EXECUTE CONTINGENCY PLANS.				
Advise Cdr on situation.	M	A	ANA	Wargame branches, revise based on status of current opns.
Make recommendations.	M	M#	ANA	Common Picture; rewargame during opns.

Execute CONPLANS on Cdr's Decision.	M	A	ANA	Wargame in progress of execution.
SUPPORTING COMBAT ARMS.				
FIRE SUPPORT ELEMENT.				
PLAN FIRE SUPPORT.				
Establish planning operations.	M	M	NC	
Plan fire support.	M	A	ANA	Wargame plan; track all resources. Screen to text; deconflict terrain, missions and resources.
Advise Cdr.	M	M#	ANA	Common Picture of options; capabilities, results of wargame.
COORDINATE FIRE SUPPORT.				
Monitor current situation.	M	A	NC	
Coordinate w/ adjacent units.	M	A	ANA	Wargame. Deconflict terrain/airspace.
Coordinate w/ Bde staff.	M	A	ANA	Deconflict terrain/ airspace. Wargame. Use of non-organic assets.
Coordinate Bde fire support.	M	A	NC	
SUPERVISE EXECUTION OF PLAN.				
Process fire support requests.	M#	A	NC	TACFIRE is automated and currently fielded.
Recommend target attack guidance.	M	M	ANA	Wargame and asset management analysis based on norms.
Process TDA.	M	M	SA	Collateral inter.

PERFORM TARGET ANALYSIS.				
Perform conventional target analysis.	M	M#	ANA	Wargame results.
Perform nuclear target analysis.	M	M#	ANA	Wargame effects.
Perform chemical target analysis.	M	M#	ANA	Target effects and best unit to fire from wargame.
ASSISTANT BRIGADE ENGINEER (ABE).				
DEVELOP ENGINEER ESTIMATE.				
Conduct mission analysis.	M	M	NC	
Conduct analysis of AO.	M	A	NC	
Prepare engineer estimate.	M	A	ANA	Mission-resource analysis; track assets vs. needs.
PREPARE OBSTACLE PLAN.				
Analyze concept of operations.	M	M	NC	
Plan to support Cdr's intent.	M	A	ANA	Norms of obstacle value vs. terrain.
Develop annex.	M	A	ANA	Match fires, units to emplace/observe. Screen to text. Deconflict assets; balance taskings.
Synchronize obstacle execution to maneuver.	M	A	ANA	Same as above, for execution now.
PLAN FASCAM.				
Perform mission analysis.	M	M	ANA	Wargame; asset recommendation.
Develop plan ICW FSE.	M	A	ANA	Wargame into plan.

Coordinate with staff.	M	M#	ANA	Wargame result to see if action is completed, based on unit feedback.
DEVELOP RIVER CROSSING PLAN.				
Recommend use of engineers.	M	M#	ANA	Balance assets to tasks based on TEM/recon.
Recommend far side mobility operations.	M	M#	ANA	See above.
Integrate plan into OPORD.	M	M#	ANA	Wargame and screen to text. Asset/ mission deconflict. Terrain management.
SUPERVISE ENGINEER STAFF.				
Monitor Bde engineer opns.	M	A	NC	
Coordinate w/ staff.	M	M#	ANA	TEM MCOO. Coord on the move to support breach; synch obstacles and fires; resupply; prioritize assets.
ADA BATTERY COMMANDER AND LNO.				
COORDINATE AIR DEFENSE.				
Coordinate ADA opns w/S3.	M	M#	ANA	Common Picture; threat analysis,; passive AD; wargame.
Recommend ADA operations.	M	M#	SA	Wpn control advice.
ADA input to OPORD.	M	A	ANA	Screen to text.
PERFORM A2C2 FUNCTION.				
Function as A2C2 member.	M	M#	ANA	Wargame; deconflict airspace.
Develop A2C2 measures.	M	A	ANA	See above.

Coordinate/integrate A2C2.	M	A	ANA	Alert on ROE or A2C2 violation.
Coordinate SIF/IFF.	M	M	NC	
ARMY AVIATION LNO.				
COORDINATE ARMY AVIATION.				
Participate in planning.	M	M#	ANA	Wargame from Common Picture.
Coordinate Avn employment.	M	M#	ANA	Wargame; Common Picture; Coord. FS/SEAD/INTER.
Monitor Avn operations.	M	A	ANA	CSSCS-wargame interface.
Deconflict airspace.	M	A	ANA	Wargame to get best Avn-FS mix.

ENDNOTES

1. U.S. Army, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 3-83.

2. LTC Jon Laurich, U.S. Army Infantry Branch Chief, lecture to Infantry officers at Ft. Leavenworth, KS, 19 Oct 1993.

3. Ibid.

4. U.S. Army, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 5-7.

5. Major Joe Anderson, U.S. Army Infantry Branch Majors Assignment Officer, interview by author, notes, Fort Leavenworth, KS, 19 Oct 1993.

6. An example of the kind of scheduling that results in these time windows is found in U.S. Army, Europe, Regulation 350-1, Mandatory Training, July 1990.

7. OpCit. Also, CAS3, which is designed to enhance battalion, brigade and division level staffs by training company grade staff officers in the dynamics of staff actions, actually works against their utilization on the brigade staff. Using the timeline from the September 1993 Infantry Newsletter, officers should program themselves to attend CAS3 prior to company command, i.e., in the six to twelve months they are on the brigade staff. Officers are encouraged to complete Phase I in 6-8 months, then campaign actively to attend the nine week resident course as soon as possible. So the captain can be away from the brigade staff for 15-30% of his tenure attending the school. Regardless, the time he has remaining on the brigade staff as a CAS3 graduate after the eight to eleven months it has taken to complete the course is insignificant.

8. U.S. Army Combined Arms Command, Force Projection Army Command and Control Action Plan Executive Summary 1992, (Draft), (Ft. Leavenworth, KS, 1992), p. 18.

9. U.S. Army Combined Arms Command, Command and Control Vehicle Final Draft Operations Concept Staffing, (Ft. Leavenworth, KS, 10 May 1993), p. 11.

10. CPT James B. Henderson, IVIS Operational Concept, (Ft. Knox, KY, July, 1992), p. 2.

11. U.S. Army Combined Arms Command, Maneuver Control System, (Ft. Leavenworth, KS, Dec 1990), p.15.

12. OpCit.

13. U.S. Army Operations Tactical Data Systems Project Management Office, User Functional Description (UFD) for the Maneuver Control System, (Draft), (Ft. Monmouth, NJ, 1 Sep 93), p. 2-33. This passage in the monograph represents the fusion of IVIS-Plus and ATCCS III. The importance of distributing information only to the appropriate echelon and situation is key. Failure to do so will overburden each soldier/combat system with an unmanageable data storage and manipulation requirement.

14. U.S. Army Combined Arms Command, Army Battle Command System Briefing, (Ft. Leavenworth, KS, 31 Aug 1993), pp. 32-33.

15. Pat Petrell, Systems Analyst, Systems Branch, Material Programs Division, Command and Control Directorate, Combined Arms Command, Combat Developments, interview by author, author's notes, Ft. Leavenworth, KS, 15 Oct 1993.

16. U.S. Army Combined Arms Command, Force Projection Army Command and Control Action Plan Executive Summary, (Draft), (Ft. Leavenworth, KS, 1992), p. 10.

17. Ibid., p.11.

18. U.S. Army Combined Arms Command, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 5-8.

19. The CP design and resources are detailed in Section II. The projection represents an amalgamation of the three major programs that will effect the performance of the brigade battle staff.

20. The assumption that enemy countermeasures and friendly fratricide will not significantly impair ATCCS Blocks III or IV is imbedded in the digitized battlefield philosophy. As explained in Section V, the vulnerability of ATCCS Block IV is substantially less than Block III, because of its inherently internal operating range.

21. U.S. Army Combined Arms Command, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 3-83.

22. The future configuration of the brigade battle staff and the resources at its disposal discussed in Section II is a projection by the author of three critical programs, all in varying stages of conception, testing or development. IVIS-Plus is a program that is being spliced together as the basic capabilities of IVIS are

proven, and improvements are being made almost monthly. For instance, IVIS-Plus may be subsumed into an application of MCS called Brigade and Below Command and Control (B2C2). Indeed, the vision of ATCCS itself has undergone significant change as the Army tries to recoup its initial investment in the Version 11 MCS software, which failed to meet expectations. The history of MCS is instructive about the risks of looking into the future. Many of the capabilities of ATCCS Block III were initially planned for the original MCS. But technical difficulties and funding constraints led to a decision to field it before it was fully mature. The ongoing problems with development of the entire ATCCS program are detailed in the 1992 Battlefield Automation, Planned Production Decision for Army Control System Is Premature, a Briefing Report by the U.S. General Accounting Office Report to the Chairman, Subcommittee on Defense, Committee on Appropriations, House of Representatives. Despitethese risks, if one does not look to the future, our C2 systems will be never catch up to our maneuver, fire and intelligence systems. One must accept the inevitable risk that projections of the future may look foolish in hindsight.

23. FMC, XM4 Command and Control Vehicle (C2V), (Santa Clara, 1992), pp. 1-2.

24. U.S. Army Combined Arms Command, Command and Control Vehicle Final Draft Operations Concept Staffing, (Ft. Leavenworth, KS, 10 May 1993), p. 16-17.

25. Ibid., p. 10.

26. Ibid., p. 11.

27. Ibid., p. 17.

28. Ibid., p. 7.

29. Ibid., p. 4.

30. Ibid., p. 14.

31. Ibid., p 16. Also, see discussion in Annex A.

32. Ibid., p. 9.

33. CPT James B. Henderson, IVIS Operational Concept, (Ft. Knox, KY, July 1992), p. vi.

34. Ibid., p. 2.

35. Ibid., p. 2. This actually represents the fusion of the IVIS -Plus and ATCCS Block III. The specific Block III component acting as the IVIS-Plus system parent will be MCS. It is this Common Picture function that makes MCS the Force Level Control component.

36. Ibid., p. 32.

37. Ibid., pp. 31-33.

38. Ibid., p 44. The process of aggregation is done jointly by IVIS-Plus and MCS at the battalion level since that is where the two systems first interface. The concept is for MCS to be able to automatically read IVIS data through an internal translator.

39. The brigades' access to ASAS will probably be imbedded into MCS, not as astand alone system. An alternative is that the IEWSE will import ASAS into the brigade.

40. U.S. Army Operations Tactical Data Systems Project Management Office, User Functional Description (UFD) for the Maneuver Control System, (Draft), (Ft. Monmouth, NJ, 1 Sep 1993), pp. 2-9 - 2-10.

41. U.S. Army Combined Arms Command, Army Battle Command System Briefing, (Ft. Leavenworth, KS, 31 Aug 1993), p. 20-6.

42. OpCit., p. 2-9.

43. OpCit., p. 6.

44. Pat Petrell, Systems Analyst, Systems Branch, Material Programs Division, Command and Control Directorate, Combined Arms Command Combat Developments, interview by author, author's notes, Ft. Leavenworth, KS, 15 Oct 1993.

45. Ibid.

46. See Annex B for complete list and analysis of tasks and subtasks.

47. The initial analysis of how the C2V and near-term automation will impact on the brigade staff was performed by the Battle Command Battle Lab at Fort Leavenworth, KS. Their results are shown in Annex B. The staff elements that BCBL did not assess were analyzed by the author using the BCBL methodology. The author subsequently analyzed the effects of ANA-enhanced ATCCS Block IV on the battle staff's tasks using a less aggressive definition for what constitutes an actual ANA improvement to the staff's workload. This is to strike a balanced view of the possible shortcomings of the system as deployed versus as advertized.

48. See Annex A.

49. The addition of IVIS-Plus systems in the vehicles of the Special Staff may improve their interface with ATCCS, but there are no indications that they will be so equipped. The critical disconnect between the Special Staff and ATCCS is the fact that their jobs generally require them to establish personal contact to

be effective. No amount of automated decision aids can help them to negotiate with civilians, counsel or administer religious or legal services to soldiers, conduct medical procedures, or organize the staff. It is for the same reason that the commanders and leaders operate from Common Picture terminals rather than full-up ANA workstations. Their success is tied to their interpersonal leadership skills, which can not be quantified or automated.

50. See Annex B.

51. See Annex B.

52. U.S. Army Program Executive Office, Command and Control Systems, Terrain Evaluation Module (TEM), (Ft Monmouth, NJ, 1992), p. 1.

53. U.S. Army Combined Arms Command, Maneuver Control System, (Ft. Leavenworth, KS, December 1990), p. 19. This function is essentially founded on Terrain Evaluation Module technology, currently expected to be imbedded as an MCS application in ATCCS Block III.

54. U.S. Army Combined Arms Command, Force Projection Army Command and Control Action Plan Executive Summary, (Draft), (Ft. Leavenworth, KS, 1992), p. 69.

55. U.S. Army Operations Tactical Data Systems Project Management Office, User Functional Description (UFD) for the Maneuver Control System, (Draft), (Ft. Monmouth, NJ, 1 Sep 1993), p. 2-10.

56. Ibid., p. 2-8 - 2-9.

57. CPT James B. Henderson, IVIS Operational Concept, (Ft. Knox, KY, July 1990), p. C-9.

58. U.S. Army Combined Arms Command, Command and Control Vehicle Final Draft Operations Concept Staffing, (Ft. Leavenworth, KS, 10 May 1993), p. 9.

59. U.S. Army Program Executive Office, Command And Control Systems, Terrain Evaluation Module (TEM), (Ft. Monmouth, NJ, 1992), p. 1.

60. This is not an advertized function of MCS, it is a field expedient method of improving the operation. This technique is time intensive and requires a different map file to avoid having it unintentionally appear on graphics transmitted to the force. Nonetheless, it is a utility that a diligent operator can exploit.

61. U.S. Army Combined Arms Command, Maneuver Control System, (Ft. Leavenworth, KS, December,1990), pp. 23, 24, 26.

62. This will remain a manual process under ATCCS Block III, enhanced by Common Picture and the MCS ability to rapidly transmit the picture to other CPs.

63. The ALO has radio eavesdrop capability on the U.S. Air Force Fighter Control Net. The data from these transmissions would have to be manually entered into the enemy database based on the degree of confidence placed on the report. The Army Aviation attack helicopters are envisioned to be IVIS-Plus equipped, hence would be able to down-link to the supported brigade's CP automatically.

64. Ronald Mullen and David Noble, "Information Presentations for Distributed Decision Making", Science of Command and Control, Coping With Uncertainty, (Washington D.C., 1988), p. 128.

65. U.S. Army Combined Arms Command, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 5-8.

66. U.S. Army Combined Arms Command, Army Battle Command System Briefing, (Ft. Leavenworth, KS, 20 Oct 1993), p. 40.

67. Man's ability to cope with details and complexity decreases in conditions of fear, stress and fatigue. The wargaming process is particularly complex, involving computations of force ratios, time-space analyses, and synchronization of multiple, interdependent forces. This phenomenon has been confirmed at the Combat Training Centers (CTC) and in Desert Storm. The author's experience as an Observer-Controller at the National Training Center (NTC) and as a Brigade S3 in Desert Storm and at the Combat Maneuver Training Center (CMTC) reinforce these observations. As fatigue and stress increase, the number of factors considered by the staff decreases, as does their mental acuity. There is an impetus to 'get ahead' so that they can regain their equilibrium, which has been eroded by sleep deprivation and stress. This translates in the near term into taking shortcuts, not double checking work, and accepting the what they believe is the commander's preferred course of action and outcome. Unfortunately, the staff is rarely to gain ground on the problem; careless work done in the present usually must be redone later. This puts the staff even further behind, and exacerbates the problem.

68. Gary A. Klein, "Naturalistic Models of C3 Decision Making", Science of Command and Control: Coping With Uncertainty, (Washington D.C., 1988), p. 87.

69. James P. Kahan, D. Robert Worley, and Cathleen Stasz, Understanding Commander's Information Needs, (Santa Monica, CA, June 1989), pp. 72-73.

70. Ibid.

71. Ibid., p. 72.

72. The capability described in Section IV has been demonstrated in a number of office-bound simulations and analytic computers. A proven example of this capability is the Tactical Commander's Training Course computer and software. This program operates off a Hewlett-Packard computer. It is the size of an average briefcase, and can aggregate the results of two Soviet-style Motorized Rifle Regiment's combat actions. While the author is not advocating this or any other specific hardware/software solution, the capabilities of this system meet or exceed those of the COA wargaming demands described in this monograph.

73. OpCit., p.1-14.

74. Ronald Mullen and David Noble, "Information Presentations for Distributed Decision Making", Science of Command and Control: Coping With Uncertainty, (Washington, D.C., 1988), p. 128.

75. OpCit., p. 1-14.

76. Pat Petrell, Systems Analyst, Systems Branch, Material Programs Division, Command and Control Directorate, Combined Arms Command Combat Developments, interview by author, author's notes, Ft. Leavenworth, KS, 15 Oct 1993.

77. WARRIOR/HAWKEYE, Tactical Commander's Training Course, and TEM can all perform this function to a large degree. The decision is, which program to use?

78. U.S. Army Combined Arms Command, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 3-83.

79. This capability was demonstrated to the author by Major Mort Orlov using an Apple Powerbook 180 Laptop computer. The slaving of events to one another, and automatic prompts for necessary related events is currently available even in handheld calculators.

80. Both electronic pencils and flatscreen technology are commercially available today. Electronic pencil is scheduled for Block III. The flatscreen monitor is prohibitively expensive at present, being a new technology. By the time Block IV is mature and ready for testing, this technology will have dropped in price considerably, like all its electronic predecessors.

81. TEM and WARRIOR/HAWKEYE are already substantially capable of performing this function. What is lacking is the interface with current or projected unit databases so that the operator need not input this manually.

82. While a generic Army database will be initially necessary, as units gain experience in training or in a theater of operations, they will learn to update their databases. This capability, along with the need to input unit specific SOP norms and parameters is what keeps ANA-enhanced ATCCS Block IV from becoming a Soviet-style 'initiative inhibitor'. The ability to track unit resource expenditures by type of operation is embedded in technology systems as simple as the Standard Army Training System (SATS).

83. U.S. Army Combined Arms Command, Field Manual 101-5, Command and Control for Commanders and Staff, (Coordinating Draft), (Ft. Leavenworth, KS, July 1992), p. 1-14.

84. U.S. Army Combined Arms Command, Command and Control Vehicle Final Draft Operations Concept Staffing, (Ft. Leavenworth, KS, 8 June 1993), p. 16.

85. OpCit., p. 1-14.

86. Ibid., p.5-7.

87. U.S. Army Combined Arms Command, Combat Developments, Force Projection Army Command And Control Action Plan Executive Summary, 1992, (Draft), (Ft Leavenworth, KS, 1992), pp 5, 10.

88. In fact, the original fielding of MCS and TACFIRE are prime examples. The equipment was fielded prematurely to get commanders and staffs into the habit of dealing with the electronic battlefield and to gain experience from the field on how to improve future versions. In the case of TACFIRE, it has taken almost a decade to reverse the initial rejection of the system. MCS is,in many commanders' eyes, still an unmitigated burden rather than a valuable decision aid.

89. OpCit., p. 5-8.

BIBLIOGRAPHY

Books

Andriole, Stephen J. High Technology Initiatives in C^3I. Washington D.C.: AFCEA International Press, 1986.

--Principles of Command and Control. Washington D.C.: AFCEA International Press, 1987.

--Artificial Intelligence and National Defense: Applications to C^3I and Beyond. Washington D.C.: AFCEA International Press, 1987.

Barnaby, Frank. The Automated Battlefield. New York: Free Press, 1986.

Bellin, David. Computers in Battle-Will They Work?. Boston: Harcourt Brace Jovanovich, 1987.

Boyes, Jon L. Issues in C^3I Program Management. Washington D.C.: AFCEA International Press, 1984.

Brown, Frederic J. LTG (Ret.) The U.S. Army in Transition, Landpower in the Information Age. Washington D.C.: Brassey's, 1993.

Druzhinin, V.V. Decision Making and Automation: Concept, Algorithm, Decision (A Soviet View). Moscow, 1972.

Johnson, Stuart E. Science of Command and Control: Part I Coping With Uncertainty. Fairfax: AFCEA International Press, 1988.

--Science of Command and Control: Part II Coping With Complexity. Fairfax: AFCEA International Press, 1989.

Kahan, James P. Understanding Commanders' Information Needs. Santa Monica: Rand, 1989.

Klein, Gary A. "Naturalistic Models of Decision Making", Science of Command and Control: Coping with Uncertainty. Fairfax: AFCEA International Press, 1988.

Mullen, Ronald; and Noble, David. "Information Presentations for Distributed Decision Making", Science of Command and Control: Coping with Uncertainty. Fairfax: AFCEA International Press, 1989.

Snyder, Frank M. Command and Control: Readings and Commentary. Cambridge: Harvard University, 1989.

van Creveld, Martin. Command in War. Cambridge: Harvard University, 1985.

--Technology and War, From 2000 B.C. to the Present. New York: Free Press, 1989.

--The Training of Officers. New York: Free Press, 1990.

--The Transformation of War. New York: Free Press, 1991.

SAMS and MMAS MONOGRAPHS

Bozek, Gregory J., Major. Battalion Level Tactical Decision Making: Can Automation Make a Difference?. 1992.

Cox, Robert D., Major. Information Pathology and the Army Tactical Command and Control System (ATCCS): Is ATCCS a Cure?. 1990.

Henderson, James B., Captain. IVIS Operational Concept. 1992

Kienle, Frederick R. Major. Operational Symbols: Can a Picture be Worth a Thousand Words?. 1992.

Neky, Patrick L., Major. Mastering Command and Control: The Brigade Commander's Environment in the Airland Battle. 1990.

Pennypacker, William S., Major. Automation: The Commander's Key to Victory in the AirLand Battle or Another Source of Friction?. 1987.

Smith, Kevin B., CPT. The Calculus of War: The Role and Use of Quantitative Decision Aids at the Tactical Level of War. (MMAS) 1993.

Townsend, Robert N., Major. Tactical Automation on the Battlefield; Who is in Control?. 1991.

Manuals and Government Publications

Field Manual 71-3, Armored and Mechanized Brigade. Washington D.C.: HQ, Department of the Army, 1988.

Field Manual 71-3 MTP, Mission Training Plan for the Armored and Mechanized Brigade. Washington D.C.: HQ, Department of the Army, 1990.

Field Manual 100-5, Operations. Washington D.C.: HQ, Department of the Army, 1993.

Field Manual 101-5, Command and Control for Commanders and Staff. (Coordinating Draft), Ft. Leavenworth, KS: Combined Arms Command, 1992.

U.S. Army. Army Battle Command System Briefing. Ft. Leavenworth, KS: Combined Arms Command Combat Developments, 1993.

U.S. Army. Command and Control Vehicle Final Draft Operations Concept Staffing Memorandum. Ft. Leavenworth, KS: Combined Arms Command Combat Developments, 8 June 1993.

U.S. Army. Executive Decisionmaking Process During Combat: A Pretest of the Content Analysis Schema. San Diego: Horizons Technology Inc., 1992.

U.S. Army. Force Projection Army Command and Control Action Plan (U)-Executive Summary 1992. (Draft), Ft. Leavenworth, KS: Combined Arms Command Combat Developments, 1990.

U.S. Army. Maneuver Control System. Ft. Leavenworth, KS: Combined Arms Command Combat Developments, 1990.

U.S. Army. Operational Requirements Document for Mobile Command and Control (C2) Capability for Heavy Forces Command and Control Vehicle (C2V). Ft. Leavenworth, KS: Combined Arms Command Combat Developments, 1993

U.S. Army. System MANPRINT Management Plan for the Command and Control Vehicle in Support of Milestone I/II. Ft. Leavenworth, KS: Combined Arms Command Combat Developments, 1993.

U.S. Army. Terrain Evaluation Module (TEM). Ft. Monmouth, NJ: Command and Control Systems, 1992.

U.S. Army. TOE Handbook 87042L-CTH, Commander's TOE Handbook: Headquaters and Headquaters Company, Heavy Division Brigade. Washington D.C.: Department of the Army, 1990.

U.S. Army. U.S. Army, Europe, Regulation 350-1, Mandatory Training. Heidelberg, FRG: USAREUR HQ, 1990.

U.S. Army. User's Functional Description of the Maneuver Control System. (Draft), Ft. Monmouth, NJ: Project Management Office, Operations Tactical Data Systems, 1993.

U.S. Government Accounting Office. Battlefield Automation: Army Tactical Command and Control System's Schedule and Cost. Washington D.C.: 1992.

U.S. Government Accounting Office. Battlefield Automation: Planned Production Decision for Army Control System Is Premature. Washington D.C., 1992.

Corporate Publications

FMC Ground Systems Division, XM-4, Command and Control Vehicle, (C2V). Santa Clara: 1990.

Interviews and Briefings

Anderson, Joe, Major. Majors Assignments Officer, Infantry Branch, PERSCOM.

Burkhardt, Ralph L., LTC. Chief, Battle Command Battle Laboratory, Experimentation Division, Combined Arms Command Combat Developments, Ft. Leavenworth, KS.

Coester, Bill, Major. Chief, Systems Branch, Material Programs Division, Command and Control Directorate, Combined Arms Command Combat Developments, Ft. Leavenworth, KS.

Laurich, Jon, LTC. Chief, Infantry Branch, PERSCOM.

Petrell, Pat. Systems Analyst, Systems Branch, Material Programs Division, Command and Control Directorate, Combined Arms Command Combat Development, Ft. Leavenworth, KS.

Treat, Dwayne, Major. Chief, Maneuver Control Fielding Team, Combined Arms Command Combat Developments, Ft. Leavenworth, KS .